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A
TREATISE ON ELEPHANTS.

THEIR TREATMENT IN HEALTH AND DISEASE,

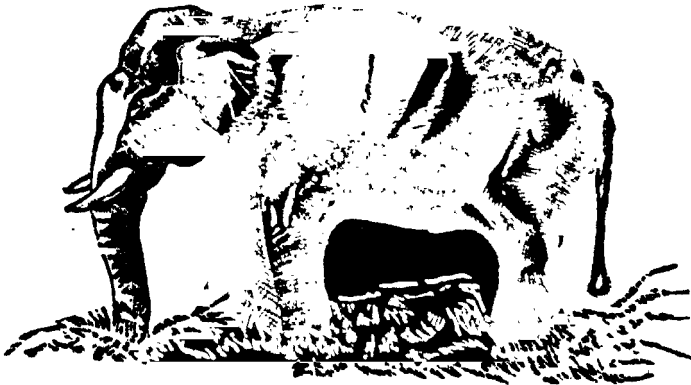
BY

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PREFACE

WHEN accepting the task of revising the work on elephants originally written by the late Mr. M. J. Slymm, Deputy Conservator of Forests, Burma, I did not comprehend the magnitude of the task I had somewhat hastily undertaken.

For reasons which will be noted hereafter, I have ventured to strike out on lines very different from that author, and this has necessitated re-writing the whole work, not revising it as I first attempted to do.

During a residence of twelve years in this province I have been thrown much into contact with elephants, both wild and domestic, and I have often had cause to deplore the treatment meted out to this most useful and valuable animal while in health. I have therefore dealt thoroughly with this subject, and its important bearing on disease.

For our present knowledge of the diseases of elephants we are chiefly indebted to the labours of Gilchrist, Hawkes, and Steel, who, in addition to their multifarious duties, found time to give this very important subject their careful attention. Steel brought the subject out of chaos, and gave us the lines on which to treat the animal scientifically. I have availed myself, whenever possible, of the valuable information contained in the works of the authors referred to, and combined it with the teachings of my own experience, and I hope that the resulting whole will be found to meet to a considerable extent the needs of those for whom it is primarily intended. Since the last edition of Slymm's work, published in 1878, science has progressed by strides, and much that at that time was enshrouded in mystery has been made clear, rendering necessary extensive additions to, and modifications of, the original work. The science of the treatment of the diseases of the elephant is, however, still in its infancy, and increase of knowledge of the peculiarities of their diseases must come slowly.

Few Veterinary Surgeons are thrown much in the way of these creatures, and fewer still have had an opportunity of a lengthy experience of them. The majority of animals, when sick, are out of reach of any skilled medical treatment and observation, and in consequence many opportunities of furthering the study of their complaints are lost. It is a regrettable fact that so invaluable, patient, and long-suffering an animal should usually be left to the tender mercies of his mahout. I have seen a good deal that goes on behind the scenes in the treatment of elephants which does not reflect credit on the humanity of some owners, who, it is to be hoped, are quite ignorant of what goes on behind their backs. The fact that the elephant is a delicate animal and that much care is required to be bestowed on him, even when in health, is not generally known, and this is probably the reason why European supervision over the mahouts and the elephants under their charge, is not insisted on by elephant-owners. European supervision, whenever possible, is in my opinion, of paramount importance to ensure that the elephants receive humane treatment and are kept in health. Without this there is the perpetual risk of illness and the inconveniences arising therefrom. In order to correct the existing state of affairs and bring European supervision to dominate over native, I have endeavoured, in re-writing the work, to make it one of practical value to those who most frequently have to deal with elephants, and in whose power it is to exercise supervision and humanity rather than to those who have medical or other scientific attainments.

Frequent discussion with many gentlemen largely interested in the welfare of elephants leads me to think that this work may meet an existing want, which is its main object. With this end in view I have tried, whilst incorporating the pith of the original work, to simplify it by re-casting and tabulating, so as to make it more easy to refer to. I have modified parts where the progress of science demanded it, and have eliminated, as far as possible, all technical phraseology and medical terms, substituting easy, familiar language that can, I trust, be readily understood by all. Several parts of doubtful value have been omitted, especially the voluminous

prescriptions with a multiplicity of ingredients—many difficult or impossible for ordinary individuals to procure, and others of dubious virtue. For these I have substituted formulæ of attested value, the constituents of which are easily procurable. I hope thus to have enhanced the value of the old work and increased its practical utility.

The elephant is such a costly animal that I feel sure owners would advance their own interests by acquainting themselves with what has been laid down in these pages, for by compelling a more searching enquiry and investigation into the care and treatment of their animals, especially in health, through the medium of their European employés, disease would in all probability be reduced to a minimum, better and more labour could be exacted, and the life of the animals prolonged, and last, but by no means least, elephants would receive that humane treatment which I feel sure it is the great desire of all owners to extend to them. It is also hoped that some gentlemen who have ample opportunities of studying elephants and their diseases will be good enough to keep notes of cases, &c., any information likely to add to our knowledge of their ailments will be most gratefully received.

In conclusion it affords me great pleasure to acknowledge with thanks the help I have received from many friends and acquaintances. Mr. C. B. Lacey, Bombay-Burma Trading Corporation, Limited; Messrs. Danson and Petley, of Messrs. J. Darwood and Company, who have had a very lengthened experience of elephants, were ever ready to afford useful information; I am also indebted to them for photographs. To Captains F. W. Thomas, T. Robinson, I.S.C., and A. G. Stuart, Royal Scots, for the drawings, to Captain Wall, I.M.S., for his valuable assistance as well as for many suggestions made during the progress of the work, and to Mr. J. F. Regan, Superintendent, Government Printing, who has taken great trouble while the work was passing through the Press. I must also plead indebtedness to many publications in various journals, from which I have derived much information, notably those in the Quarterly Journal of Veterinary Science in India by my friend the late J.

H. Steel, A.V.D., the valuable works of Gilchrist, Hawkes and others, but more especially to those of Sanderson, Steel, and Miall and Greenwood, from which books I have freely quoted, and must tender my apologies for the liberty taken in doing so. I trust, however, that a desire to foster and procure greater care and more humane treatment for the elephant may be accepted as my excuse.

From what has been said it will be seen that a great portion of the book represents the summing-up of others' researches on this interesting subject, thereby reducing my share of it to a minimum.

FYTCH ROAD: }
RANGOON. }

GEO. H. EVANS,
Army Veterinary Department

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- ASHBY.—“Notes on Physiology.”
- BAKER.—“The Rifle and the Hound in Ceylon.”
- BROWNING.—“Siam, its Kingdom, and its People.”
- BURN.—“Notes on Transport and on Camel Corps.”
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A TREATISE ON ELEPHANTS.

CHAPTER I.

GENERAL USES—SUPPLY—AGE—HEIGHT—MARKS OF IDENTIFICATION—VALUE—PURCHASE—
IDIOSYNCRASIES—SALES—BREEDING—PREGNANCY—PARTURITION—MILK.

General uses.

AN animal possessed of such strength and docility as the elephant must be useful wherever he thrives. In a country like this his services can readily be appreciated, large areas being covered by dense impenetrable jungle, immense marshy tracts, steep hills, deep ravines, and intersected by rivers, large and small. In the absence of waterway in a country such as described, he is more than useful, he is indispensable. Mules, ponies, and bullocks can travel along bridle-paths, and at times over very rough ground; buffaloes can drag timber, &c., over level ground, but an elephant can be ridden, drag timber, or carry a cart-load through dense pathless forests, and over the worst ground. His immense size and weight enables him to make a fair track as he moves along; and he can cross wide rivers, ford fast-running streams, carry men and baggage across swamps and heavy-marshland, penetrable to no other kind of transport animal. On the back of an elephant, the engineer, forester, or surveyor is raised above the surrounding undergrowth, which otherwise would shut out his view in all directions, and thus can more rapidly form a conception of his surroundings. He can take with him heavy instruments, and strike across country in any direction he pleases. In this province elephants are very extensively employed in the timber industry; in fact the industry may be said to depend in a great measure on the ability to procure elephant labour. The valuable timbers are scattered over such extensive areas, that it is impossible to construct sufficient useful roads of transport and timber slips, as it would be necessary to make a road or slip to each single or small group of logs; and the great importance of having elephants for timber operations

consists in their peculiar suitability to the work of collecting logs together over great stretches of hilly country. It is necessary to see some of these immense logs to understand the amount of labour required to drag them through jungle, over ridges, down ravines, to the floating streams. Again, when a stream is in flood and the logs become jammed and piled up, or are stranded on sandbanks, the volume of water coming down, and the strength of the current are so great that elephants only can perform the Herculean task of entering the stream to clear a block or "dike" (ἄσ), push stranded logs into the stream, and guide them round sharp turnings. When the timber arrives at the rafting stations, elephants, owing to their immense strength, materially assist in sorting the timber for the rafts. In the large saw-mills machinery is replacing most of the work done by elephants, but in the smaller ones they are still employed to drag the logs from the river, and after they are squared, they remove and stack them almost as neatly as a human being. In all these operations they are efficient and cheap.

My experience of elephants as transport animals is, that they are decidedly good. Provided they receive proper care and supervision, they do not as a rule fall sick, and are capable of performing a vast amount of work. They have few vices, are gentle, obedient, and patient. Too frequently, however, they do not even receive the ordinary attention bestowed on other transport animals, being left to the tender mercies of the native attendants, and they are in consequence often neglected, and as a result unjustly condemned. Though of such great size and strength, if neglected, they rapidly go to pieces. They are constantly disabled from sore backs and feet, the majority of such cases being due to want of a little care and supervision. As with all animals, the first and most important matter to attend to is, that they be allowed an ample allowance of drinking water and abundance of food, and, above all, the greatest care must be taken to ensure that they *receive* their allowance. On service, where animals cannot be permitted to graze, it is imperative that the persons in charge should see that they receive a sufficiency of food and water. Elephants require only a small amount of sleep, but to ensure their obtaining it all food should be presented to them at an early hour of the evening, as otherwise they spend the night munching their food and get no sleep at all. Care must be taken to see that they are carefully loaded, not overloaded (which is too often the case), not recklessly exposed to heat, that parts exposed to irritation are regularly examined before and after work, also that they are not overworked, and are at all times saved unnecessary labour; then, and then only, will those in charge be repaid for their care and attention. In this and adjacent countries these

creatures are valuable, as in most places except perhaps parts of the north of Siam, food and water are abundant. The physical condition of the country, the absence of roads, deep forests, marshy tracts, deep and wide rivers, steep hills and deep ravines, all point to the elephant as being the transport animal best calculated to surmount such difficulties. The advantages in employing them are—

- (a) They are plentiful, can fairly easily be obtained by hire or purchase, require no rations to be carried—fodder in most places being plentiful—and most of them are trained to jungle work and accustomed to roughing it.
- (b) When reasonably loaded, they march at a fairly good pace, and in difficult country could keep up with troops, or would not be left far behind. As they require little sleep, they might, with light loads, be employed on a forced march.
- (c) On the line of march they occupy little space, and are thus economical as regards escorts. Their great strength permits of their being employed on odd jobs.
- (d) They can be best employed at the base of operations, and along the line of communications, as they are less exposed to capture or attack, and can be more easily fed.
- (e) They only require the same care and supervision necessary to the efficiency of any other kind of transport animal.

Objections.—One of the chief objections to their employment is that they will not, as a rule, stand fire; they are easily alarmed; the sight of small animals to which they are unaccustomed often causes them to bolt.

- (b) They can be seen in open country from a considerable distance, and their large carcasses afford fine targets for an enemy.
- (c) They cannot be employed in cold climates.

Supply.

The Karens, Talmes, and Laos tribes inhabiting the country between the rivers Salween and Me-Ping, the Karens on the western side of the Salween, in Karenni, and to a smaller extent the Shans to the north, and the Laos tribes in certain parts of the valley of the Me Nam, are the chief sources of supply of more or less trained elephants. In this somewhat sparsely populated and little cultivated country, intersected by rivers and mountain chains, the

elephant finds a congenial home, and it is in this country, inhabited by shy and retiring people, that a number of elephants are bred in captivity. Elephants in these parts are used chiefly for transport purposes between villages, and are a conspicuous element in all festivities held by Chiefs. Young tusker calves, when not more than five or six years of age, find a ready sale among the numerous Chiefs of the Shan and Laos tribes, and Siamese officials, at prices from three to five hundred rupees. As much as twelve hundred rupees has been offered for a promising ten-year old tusker. The wealth of many Chiefs consists largely of elephants, some of them owning as many as one hundred animals, and continually adding to the number. One of the great amusements of the Chiefs is, to watch the training of their animals; this training begins at an early age, when the elephant is taught to submit to a man riding on his back or neck; he is then taught to carry a saddle and small load, and later to drag timber. When an animal is being taught to drag, he is taken with a trained elephant to the sandy bed of a dried-up stream, and put in harness; if he is obstinate and shows temper, the old elephant is given a long tow rope which is attached to the youngster, and at a given signal he moves off, towing the youngster, who frequently falls, but is nevertheless towed along on his back or side, as the case may be; after a few such lessons, he learns how to drag; but it is not till an animal reaches the age of twenty that any serious work is expected of him. Till he is full grown he is a pet and, if a fine animal, an object of admiration in a cavalcade of elephants on festival occasions.

Elephants used also to be brought from the Mèkong Valley, quite a large number annually finding their way from this source through Siam to Burma; but in the future it is improbable that many animals will be obtained from this direction. In a recent report of Her Britannic Majesty's Minister at Chiengmai, I noticed the following paragraph:—

“Elephants were at one time imported from Luang Prabang in large numbers. The French authorities now discountenance the export, naturally wishing to retain so useful an animal in French territory. The price of elephants has accordingly risen twenty-five per cent. Prices of timber-working tuskers now range from Rs. 2,000 to Rs. 3,000, and of good travelling females from Rs. 1,300 to Rs. 2,000. The number of elephants of all classes in Chiengmai, Lampun, and Lakhon may be roughly estimated at two thousand five hundred, and the demand for them is so great, that there are a number of buyers in the market, who are unable to supply their requirements at anything approaching reasonable prices. Some ten to twenty wild elephants are captured annually by the trained catchers of the Chiefs of Nan, but the supply, so the Chief of Nan informed me when I visited that place, is becoming scarce, with the result that Chiengmai

buyers are now looking to the west or Moulmein side rather than to the east or Nan and Luang Prabang side for the supply."

Domestic elephants are plentiful enough, and the supply under ordinary circumstances is equal to the demand; but of late years the demand in the timber industry has been, and is still, so excessive, that prices have run up very considerably, but it is anticipated that in the course of a few years they will fall to, or even below, the ordinary rates. One point, however, must never be lost sight of, namely, that the supply of these animals must always be kept up. As necessary as it is to provide a future supply of timber, so needful is it to preserve the means of turning the timber, when matured, to account.

Age.

The limit of age in elephants and the indications of the age an individual has reached are not accurately known. It is natural to suppose that in the wild state they attain a much greater age than in captivity. In the latter condition they not infrequently die prematurely from preventable causes. That they do sometimes live to a great age is pretty certain. An instance of this is recorded in "Beeton's Dictionary of Natural History," namely, that amongst the papers of Colonel Robertson (son of the historian of Charles V), who held a command in Ceylon in 1799, shortly after the capture of the Island by the British, is one showing that a decoy was then attached to the elephant establishments at Matura, which the records proved to have served with the Dutch during the entire period of their occupation (extending to upwards of one hundred and forty years), and was said to have been found in the stables by the Dutch, on the expulsion of the Portuguese in 1656. This, however, is an extreme example of longevity from which it would be unsafe to generalize. Burmans and Karens, having considerable experience with elephants, give the period of life from eighty to one hundred and fifty years. The former designate the periods of growth as follows:—

From 25 to 35 years, *hsin-nu* (ဆၢနု) = immature, *i.e.*, young and soft.

From 35 to 45 years, *kyi-byi* (ကြီးပွဲ) = full grown.

From 45 to 50 years, *hsin-daing* (ဆၢငံး) or *mundi* (မုၤနီ) = "midday" or middle aged.

From 50 to 60 years, *obyi* (ဝဲပွဲ) or *mun-lwe-byi* (မုၤလွဲပွဲ) = after midday or on the decline.

I think it is the general opinion of those who have experience of these creatures that, with the age of seventy or eighty, they generally show evidence of having reached the average term of life; but there are no data to substantiate this opinion, still less any precise statistics available on the subject. The care bestowed varies considerably, and to enable true conclusions with regard to their age limit to be drawn, only those cases in which elephants have received adequate care and attention should be considered. "The elephant is full grown, but not fully mature, at about twenty-five years of age, but is not in full vigour and strength till thirty-five"—(*Sanderson*).

There is little difficulty about judging the age of a young full-grown elephant, or a very old one; but it is anything but easy to tell those of middle age, especially if they are in poor condition. Much information as to probable age can be gathered from the general appearance, condition of the ears, trunk, tail, &c. The appearance of an aged animal is as follows:—General condition usually poor, the head lean, the skull appearing to have little but skin over it, deep hollows are present over the eyes, and often on cheeks (sides of face); the skin covering the forehead frequently presents a cracked and warty appearance. There is often some opacity of the eyes and an abnormal flow of water from them. The edges of the ears, especially the lower, are much torn and frayed. The skin of the trunk is rough, hard, and warty, and the organ appears to have lost much of its suppleness. The skin covering the body is shiny and shrivelled. The legs are thinner than in youth, and the enormous masses of muscle seen in youth are absent; the girth of the limbs, especially just above the feet, is considerably diminished. The skin around the nails presents a broken and warty appearance. The tail is cakey, hard, and the extremity often devoid of hair. *Sanderson* notes on the peculiar action of aged animals: "Instead of walking firmly, and planting the feet flat, they bring the feet to the ground somewhat in the manner of a plantigrade animal, touching with the heels first." This peculiarity may sometimes be observed in animals of middle age suffering from debility.

The most ready way of forming an approximate idea of the age is by the amount of turn-over of the upper edge of the ear. In young animals, sometimes up to the age of eight or nine years, the edge is quite straight; it, however, then begins to turn over, and by the time an animal is thirty, the edges lap over to the extent of an inch, and between this age and sixty, this increases to two inches or slightly more. The teeth afford some evidence as to age, but is of little practical value.

Height.

Extravagant estimates of the height of elephants have from time to time been recorded; their great bulk so far exceeds that of the ordinary animals we are accustomed to see that the tendency is to overestimate their size. The old method of measuring was also most misleading; a rope was simply thrown over the back, the ends brought to the ground on each side, and half the length taken as the height. Much amusing information on this subject is contained in Sanderson's excellent work. Madras elephants, he tells us, were at one time said to be from seventeen to twenty feet high, and an animal at Dacca was said to be fourteen feet. Mr. Corse, a gentleman thoroughly conversant with elephants, determined, if possible, to see one of these enormous creatures. He accordingly took the trouble to go to Dacca, and was rather surprised to find that according to his measurement the animal said to measure fourteen feet did not exceed ten feet in height (a very good height). We may take it on the authority of Sanderson, a most careful observer, who had unrivalled opportunities of investigating such matters, that such a thing as an elephant measuring ten feet at the shoulder does not exist in India, nor I may add in Burma. The largest male he ever met with measured 9' 10", and the tallest female 8' 5".

Of three hundred males measured in this province, the average height was 7' 10½", girth 11' 10"; and of one hundred females, the average height was found to be 7' 5¾", girth 10' 11". All these animals were measured at the shoulder, as is done with horses. An elephant dealer, through whose hands some two thousand elephants had passed, stated that he had only met with one animal measuring 9' 4" at the shoulder. Mr. C. B. Lacey informs me that in Siam the tallest animal owned by the Bombay-Burma Trading Corporation measures 9' 6" at the shoulder. This fact shows how rare it is to come across an animal 9½ feet and over, for the Bombay-Burma Trading Corporation have records of a thousand and more animals, yet this is the only one they possess measuring 9' 6"; and at the present time they have some two or three thousand elephants in their employ.

Twice the circumference of the foot is as near as possible the height at the shoulder. As stated above, these animals should be measured like horses, *i.e.*, vertical measurement taken at the shoulder.

Details of measurements of 300 male elephants—

23 animals or 7.67%	height 7'-0" and under	7'-6".
57 " " 19%	" 7'-6" " "	7'-8".
94 " " 31.33%	" 7'-9" " "	7'-11".
67 " " 22.33%	" 8'-0" " "	8'-2".
59 " " 19.67%	" 8'-3" and above.	
300	100.00 average	7'-10 $\frac{1}{4}$ ".

Of the above number there were only two animals nine feet and over, namely, one exactly nine feet in height, with a girth of 14' 9", the other 9' 1", with a girth of 13' 9".

Details of measurements of 100 females—

48 animals or 48%	height 7'-0" and under	7'-6".
35 " " 35%	" 7'-6" " "	7'-8".
13 " " 13%	" 7'-9" " "	7'-11".
4 " " 4%	" 8'-0" " "	8'-3".
100	100 average	7'-5 $\frac{3}{4}$ ".

The above measurements were taken haphazard from the recorded measurements of considerably over eight hundred animals. The males from 7' and under 7' 6" were probably not fully grown, yet were sufficiently so to be working, and in all probability unlikely to grow much more.

Burmans give the height of elephants in cubits; the "cubit" employed by them being the ordinary cubit plus a hand's breadth or roughly twenty-one inches.

Marks of Identification.

Particular attention must be paid to all marks as a means of identification, as "elephant-stealing" about the frontiers is a popular and very remunerative pastime. In the forests, when the day's work is finished, the foresters as a rule put cane fetters on their animals, suspend a bell or wooden clapper (ဝေဝေဝေ), *hka-louk*, from their necks, and then turn them loose to graze; no watch is kept over the animals at night. The thief or thieves (who thoroughly understand the habits of elephants) hang about close by, waiting till the animal selected strays, when they go up, remove or cut through the hobbles, mount him, untie the clapper, and then head for the frontier. The hills, clad as they are with dense jungle, afford ample shelter; the owner, when he suspects that the animal is stolen, usually has the good sense not to waste time in pursuit. Accomplished thieves make a good deal of money, for they steal an elephant in our territory, sell him in Siam, steal him again a month or so after, bring him across our frontier, and once more dispose of him to some one at a place many miles distant from where they originally stole the beast. Distinctive marks are as a rule not very numerous on these creatures. Government animals are not branded, but those owned

by firms frequently are. The shoulder is the usual place. There is an idea that brands do not do well on the skin of the elephant; this is not the case when carefully done. I have seen many elephants carrying clear brands free from blemish. Elephants with any blemishes about the shoulders should always be looked upon with suspicion, as they are likely to be stolen animals, the brands having been tampered with. All brands should be large and clear.

Value.

Elephants may conveniently be divided into two classes, namely,—

- (a) timber elephants;
- (b) baggage, or travelling elephants.

Timber elephants may be divided into two classes, namely,—

- (1) trained tuskers,
- (2) trained males and females.

A well-trained tusker always commands a good price; he is so much more useful both in the yards and forests, as with his tusks he can "*oung*" (ဝေဝေဝေ), stack timber, assist in getting logs over obstacles, &c. Prices vary considerably with the demand, and range from Rs. 1,800 to Rs. 3,500,* according to age, good points, training, length and thickness of the ivory. Merchants are always prepared to purchase and to pay very fancy prices for really well trained animals. Though tuskers are largely employed in dragging operations, still it is tuskless males and females that perform most of this class of work. Their prices vary according to the degree of training, and run from Rs. 1,100 to Rs. 1,700 for females, and from Rs. 1,400 to Rs. 2,500 for males. Most Burmese elephants are trained to timber work.

The animals employed for baggage and travelling are often Siamese; small and fast paced females. Prices range from Rs. 800 to Rs. 1,200.

Purchase.

Dealers in elephants, it is to be regretted, are not always above suspicion, and as elephants are subject to numerous ailments, which are causes of unsoundness, and also sometimes obscure vices, too much care cannot be exercised in the examination of animals about to be purchased. It will therefore be advisable to enumerate some of the more prominent signs of health. These are constant motion,

* Quite lately prices have run to Rs. 5,000.

such as swinging of the trunk and tail, flapping the ears, swaying the body or the head from side to side, rubbing one leg against the opposite one, or swinging it. The skin is soft, almost black in colour, and the bristles covering the body are firm to the touch. The mucous membrane of the tongue and mouth is of a rich pink colour; the eyes clear and bright. The light coloured spots and blotches on the head and trunk are pinkish in colour. A moist secretion exudes around and above the nails, and is easily observed by throwing some dust on the parts; this must not, however, be confounded with an offensive discharge from beneath the nails, a wet rot, which runs high up, the affected parts being hot and painful. The appetite is good, and the animal sleeps for a few hours every night, and immediately on waking commences to feed.

The signs of indisposition are:—that the animal is listless, there is general languor, absence of the incessant motion so characteristic in health. The skin appears greyish in colour, hangs loosely, and is dry and sometimes scaly; the spots and blotches also assume this pale colour. The trunk presents a shrivelled appearance. The colour of the membrane of the mouth and that of the tongue changes to a muddy colour or is deep red, with or without blotches on the palate. The lower flap of the ear is very often cold to the touch, the eyes are dull, appear retracted, and there is frequently an abnormal flow of water from the eyes. The animal may be out of condition and feverish; the appetite small or even wanting, proper rest is not taken, and he may lie down and get up several times (generally a bad sign). If the excretions be examined, the urine may be noticed to be small in quantity, and high-coloured, and the dung hard and coated with mucous, or diarrhœa may be present.

Elephants differ as widely in their points as do horses and other animals. The chief points of a good elephant are as follows, see plates A, B, C, and D, namely, medium height, a good big barrel, skin soft and wrinkled (described by Burmans as crocodile skin), the head massive, full cheeks, and a broad forehead; the ears large, eyes bright, and kindly, and free from opacity or excessive flow of tears, the trunk of good length, broad at the root, and blotched in front with pinkish coloured spots. The neck short, thick, and full; chest broad; the back straight and broad, broad loins; short forelegs, convex in front (described by Burmans as ခုဝေ့ဆီ, *i.e.*, set up like a lion or *chinthay* ခုဝေ့, the attitude given to the monsters in front of Pagodas). The hind-quarters full, sloping well down, and supported by thick short limbs. The pads of the feet hard, action free, paces fast and easy; the tail should be of good length, free from hardness, and provided with a good tuft of bristles. Animals such as described

will not often be met with; still, when selecting, it will be as well to obtain those possessing most of the good points enumerated.

The undesirable points are numerous. Some animals are flat-sided, others have high arched backs, with very prominent spinal ridges, *see* figure 31; others are narrow-chested, with lean low fore-quarters, or are leggy, and devoid of those enormous masses of muscle seen on the fore-limbs of a good elephant. In some animals the legs are of almost uniform girth throughout; tall, leggy beasts, and those with bad fore-quarters are invariably rough in action and slow in their paces; they are, moreover, much more liable to gall, and are generally indifferent workers. Elephants with thin, light-coloured skins, even if they possess many good points, should be avoided; they are as a rule not strong, and frequently fall sick. Those animals possessed of lean heads, hollow cheeks, small restless eyes, shortish thin trunks, should be treated with suspicion, as they very often are bad-tempered.

Forsyth in his work "The Highlands of Central India" mentions that there is no end to the tricks carried out by dealers, of which he had some experience at the Sonpur Fair; some he remarks on are man-killers reduced to temporary harmlessness by the daily administration of pills containing opium and Indian hemp. Sores of the feet plugged, cracks "paid" with tow, and sorebacks surface-healed. It is most important, therefore, that in examining a beast the utmost care should be exercised to see that the back and other parts liable to gall are free from sores, scars, and tenderness; in fact the whole body must be inspected, the ears examined for sores and scabs, the ear holes for discharges, and the eyes must be free from dimness.

The soles of the feet should be well tapped all over before and after exercise; if any tenderness is manifested, the part must be thoroughly examined. Tender patches from excessive wear may readily be detected by the parts being smooth, and pinkish in colour. The skin around the nails, as also the nails, must be inspected. Food and water should be presented to see that the trunk is quite sound, as this most important organ may have been injured by bamboos, spear wounds, *da* cuts, etc.

Idiosyncrasies.

Some elephants are full of nasty tricks; intending purchasers must therefore be on their guard, and endeavour to ascertain the peculiarities of any particular beast before taking possession. Most Burmese elephants prefer being approached from the right side; very

few from the left ; some may be approached from right and left, and others only from the right or left. A new keeper unacquainted with such peculiarities incurs the likelihood of being attacked if the animal be bad-tempered, or of scaring him if of a nervous disposition.

The following peculiarities in some animals reduce their value, as they are regarded with superstitious dread by the Burmese. It is thought that the ownership of such creatures may cost their masters loss of life or substance.

(1) A loose fold of skin, descending from the throat down to the fore-legs, known as *pyaswe* (ပျားဆွဲ) (resembling bees settling in a swarm).

(2) Same as above, but the fold of skin is continued between the fore-legs on to the abdomen, called *kalaga* (ကလဲကလဲ) (like a *purdah*).

(3) Moving the head up and down, and simultaneously from left to right, called *moungdoung* (မောင်းထောင်း) (like the action of pounding rice in an ordinary Burmese rice mortar).

(4) Swinging the trunk only to the left and right, called *pa-ket-hlwe*, (ပုခတ်ဆွဲ) (swinging the cradle).

(5) A restlessness of the whole body, somewhat after the fashion of bears, called *sa-gaw-waing* (ခဲထောင်း) (action of a winnowing tray).

(6) Holding the trunk up in the air and putting it into the mouth, called *tein-nyun-sa* (တိုင်ညှန်တီး) (literally to eat the clouds), star gazing.

The conformation of an animal naturally affects its value. *Wet-kon* (ဝတ်ကန်) (pig's back), or flat backs, are considered best suited for carrying purposes.

Nga-phai-kon (ငါးပင်ကန်) (like the back of the *nga-phai* fish, *i.e.*, an even curve), or those with a slight curve of the back, are considered best for dragging purposes, as it is supposed that the dragging gear fits this class of animal better than others.

Those animals with backs described as *pyat-that-kôn* (ပြောင်ခဲကန်) (like the curve of a *pyat-that*, or sharp curve) may be employed for dragging or carrying, but great care must be exercised in attending to the gear, as such animals easily gall.

A loose fold of skin across the lower part of the neck, called *payit* (ပေါ်ရင်), is not a bad omen and rather raises the value of the animal.

Some elephants have four nails only on each foot ; this decreases their value, as five nails on each foot raises the same ; four on each of the front feet and five on the hind ones does not interfere with their value.

The male elephants called *han* (တန်) and *haing* (တိုင်) are often from 30 to 40 per cent. cheaper than tuskers. Generally speaking

they are inclined to be ill-tempered. These are probably the animals mentioned by Steel as always found single. I think their solitary life is usually not of their own seeking, but is brought about by the presence of powerful tuskers which resent their mixing with the herd, for, if they can decoy a cow from a herd, or pick up with a tame female, they will do so.

A register recording age, height, sex, marks, year and place of purchase, price, name, and residence of vendor, should be kept for reference.

Sales.

Elephants are bought and sold like other cattle, that is, the purchaser pays for the animal and takes it away. When Europeans contemplate purchasing elephants, it is advisable to come to some arrangement with the vendor regarding a trial of the animals offered for sale. A good plan is to advance the vendor fifty, or even one hundred rupees for a week's trial of an animal; at the end of which period, should the intending purchaser decide not to buy, he forfeits his advance. This course is recommended for several reasons; the animal produced for sale may have been lost or stolen; a vicious beast may be drugged with opium, or ganja, or it may be a weakly old creature fattened up for sale. The intending purchaser at least has an opportunity of observing the idiosyncrasies of the animal, also his working capabilities. Elephant-dealers, and some owners, are not above "doctoring" animals for sale. Some years ago Government directed that no sales of elephants should have effect except on fulfilment of certain formalities prescribed for the purpose. The object was, if possible, to place a check upon the extent to which elephant-stealing had attained. The measures, however, having failed, the regulations have been set aside. There is an impression current that a bill-of-sale is necessary in the case of an elephant; this, however, is an error. Registration is prescribed for the sale of immoveable property only. The solitary advantage the purchaser could derive from registering his purchase would be, that in the event of the animal having been stolen property, his honesty in the transaction would be open to no question.

Breeding.

At one time it was much doubted whether elephants ever bred in captivity. That it does happen, and not infrequently in Burma and

Siam, is beyond question. It is true that under certain circumstances, *e.g.*, when animals are constantly tied up, &c., it is very rare for them to breed; but with elephants, the property of large firms engaged in the timber industry, and those owned by contractors the case is different; after work the animals are permitted to roam about the jungles, where they lead a more natural life, and under these conditions calves are often dropped. There are many well-known cases of elephants now working, whose mothers were working for years before their birth. In Burma, where wild elephants are numerous, cases of wild males taking up with tame females are not infrequent, and tame elephants appear to have little or no difficulty in gaining admission to wild herds. As long as a sufficient number can be procured by capture, it would be absurd to attempt to breed them. Owners, especially of working elephants, have been known to offer to give away calves owing to the expense attending their keep, and the remoteness of the prospect of some return upon the outlay; and the offer has for similar reasons frequently been refused.

In the female the loose external generative opening hangs down in much the same situation as that occupied by the penis in the male. This peculiarity led to a good deal of speculation as to the manner in which union of the sexes took place; so much so, as to suggest a deviation from the analogy of other animals for this purpose. The question as to the manner in which the fecundation of the female is brought about, was set at rest at Thayetmyo, where two elephants were observed in the act, and in the position common to quadrupeds, but in order to place the matter beyond the possibility of contradiction, Mr. Porter, Schoolmaster of the Bedford Regiment, took an excellent photograph; the trunks and tails came out rather indistinctly; this Mr. Porter afterwards informed me was due to the fact that they were in constant and rapid motion. The congress lasted some time. Sanderson witnessed the action on four occasions, and on none of these did the males exhibit any signs of *musth*, which goes to prove that it is not only when under this influence that male elephants court the society of the female. One jump is considered to be sufficient. Sanderson states: "There is ample proof that it is not the male elephant that comes into season." Owing to the periodical attacks of *musth*, many people have supposed that such is the case; and he remarks that "the period of heat is not marked by any particular signs in the female, which has probably helped to strengthen the erroneous opinion spoken of. In approaching a male elephant, a female desirous of his attentions utters certain sounds, and courts his society; but only those conversant with elephants would notice this." I have never observed any apparent signs of 'heat' in the female, and several friends I consulted informed me that, though they had seen a great many elephants, and

been amongst elephants many years, they had not seen anything noticeable amongst female elephants beyond the fact already stated that the female when in that state utters certain peculiar sounds.

Pregnancy.

Sanderson states that female elephants usually give birth to their first calf at sixteen years of age, and continue to breed till they reach the age of eighty. They breed about every two and a half, or three years. I have seen two calves (wild) at heel, the elder one I do not think was more than three years of age. Sanderson has seen three. The same authority observes that the female will not permit a bull to approach until eight or ten months after calving. Burmans and Karens put it down at even a longer period.

Elephants in calf may be worked up to almost their full term, but it is only fair to relieve them from work six weeks or so before the calf is expected. Towards the end of pregnancy, females become very lazy and sluggish; the size of the animal, taken together with the fullness of the mammary glands, and the presence of milk, should afford sufficient indications of approaching parturition.

The dams, after calving, should be given a good rest, and a plentiful allowance of good nourishing fodder.

The mammary or milk glands are situated on the chest, a trifle behind the fore limbs. The young suckle with their mouths, and not with the trunk.

The duration of pregnancy may be said to vary between eighteen and twenty-two months. Sanderson gives it at eighteen months for a female calf, and twenty-two for a male. Burmans and Karens state that it may extend to two and a half years.

Mr. Petley kindly gave me notes on two cases:—

- (a) A female was covered during the first fortnight of April 1896, and a male calf was born on the 6th February 1898; 22 months.
- (b) Mr. D. S. Pritchard witnessed the tusker "Yegyan" cover the female elephant "Bohgadon" near the Yat-sauk bazaar, during the month of February 1896; she dropped a calf (female) during December 1897; Mr. Pritchard saw the calf an hour after birth; 22 months.
- (c) Steel, quoting from the *Asian* of the 5th June 1883, gives two cases, the duration of pregnancy being 583 and 680 days respectively.

In the *Indian Forester* for April 1899, Vol. XXV, page 158, signed C. B. S., a case is recorded. A female turned out with others to graze was covered in May 1897. The act was observed every evening for about a week, from about the 18th to the 25th May. Neither of the animals showed signs of sexual excitement previously, though the male paid assiduous court to the female for a few days before coition was permitted. They were both working regularly dragging timber, and gave no trouble. A female calf was born on the 3rd November 1898. The day the youngster was born, the mother had carried a light load for a short march. The calf was so weak, that it had to hold on to a bamboo with its mouth to keep itself upright. After a day it could stand and suckle. Period of gestation a little over 17 calendar months.

- (e) In two other instances brought to my notice, the periods were 19 and $21\frac{1}{2}$ months respectively; in the former case the calf was a female, in the latter a male.

The greater number of calves are dropped during the last quarter of the year.

Parturition.

Generally speaking, the period of labour is short, and the act of parturition occupies but a short time. One calf occurs at a birth as a rule.

Mr. Lidderdale kindly wrote to me describing the birth of a young elephant at Pazundaung. The cow had been working in the timber-yard during the afternoon, and after work was as usual tethered in her shed about 6 P.M. About 11 P.M. she became very restless, and groaned loudly; at about 3 A.M. she suddenly broke her hind shackles, so those on her fore-feet were removed, after which she walked out of the shed into some deep mud about five yards distant, where she promptly assumed the recumbent posture and gave birth to a female calf, in caul, which, I believe, is not an infrequent event (head and fore-feet presented). The act of parturition occupied but a few minutes. The Burman attendant, who had been present at other cases, immediately ruptured the membranes, &c., the calf remaining lying on its side (the mother standing over it) for an hour or so, after which it managed to stand up, and in a short time could walk. The "after-birth" (*achin*) came away fifteen or twenty minutes after the birth of the calf. The dam ate it.

An intelligent Burman gave me the following description:—

“When the full time has arrived, most animals are very restless, and in great agony for some few hours, and often, an hour or so before birth, there is a discharge from the passages. When about to give birth, the female seeks soft ground. The calf may be presented head and fore-feet first, or the hinder parts may appear first. If the membranes are not ruptured by an attendant, and the calf set free, the female will do so with her foot. The young one lies from one to two hours after birth, occasionally moving ears, trunk, and limbs; after which it gets on its legs, and can walk.”

Elephants even in their wild state may die in labour. Last year I found the remains of a cow elephant in the jungle, and a Burman well known to me informed me that he had seen the carcass a few days after the animal died and that the cause of death was due to her inability to expel the calf.

A young one can walk well enough after a few days to follow the mother on a short march, and here I may mention that in their wild state, when a calf has been dropped, the herd remain in the vicinity until it is able to follow the mother, which is generally in about forty-eight hours. Elephants generally eat the after-birth.

At birth the calves are usually covered with longish hair, and stand from two and a half to three feet at the shoulder. The mother should not be marched till two or three days after birth of calf.

Sanderson weighed several calves when two days old, and found the average weight to be two hundred pounds. For several months they live entirely on milk, and even for some time after they take to eating grass, their chief support is milk. The trunk of the young animal is very short, from ten to fifteen inches in length. Mothers rarely resent their youngsters being handled. The calves soon become playful and very mischievous.

Milk.

“The milk of the elephant is said to be very rich with an agreeable taste and odour, its butter and sugar being largely increased at the expense of the water as compared with other milks”—(*Steel and Symonds*).

CHAPTER II.

ATTENDANTS AND THEIR DUTIES—MANAGEMENT—NATURAL FODDER—GEAR—PACK-GEAR
—MISCELLANEOUS—RUNAWAY ELEPHANTS—GRAZING—QUICKSANDS—MOUNTING—CROS-
SING RIVERS—BOLTING—RESTRAINT—TO SECURE FOR OPERATIONS—DESTRUCTION.

Attendants and their duties.

EVERY domesticated elephant necessarily has its own particular attendant *oo-si* (ಔಃಸಿ) (the man who rides in front), or *mahout*. In the case of Government animals and those of some private owners, the *oo-si* is allowed an assistant, known as the *pai-si* (ಪಃಸಿ) (the man who rides behind). In India he is called *cowardie*. The *oo-si* either is directly under the control of his employer, or, where there are a number of animals, indirectly through an overseer, *gaung* (ಗಾಂಗ) (head), or *jemadar*. The duties of an *oo-si* is the continual immediate care of his elephant, both on and off work. In the former case, he rides on the neck of the elephant, guides it on the march, or directs it in dragging, pushing of timber, &c., and it is at all times his duty to be on the alert for means of economizing the strength of the animal, saving it unnecessary exertion and exposure. Off work it should be his first care to see that the animal receives its drinking water, bath, and a sufficiency of good clean fodder, also to see that it is kept in the shade, or in a shed, his personal convenience being secondary. He must wash and examine every part of the body daily, notice any departure from the normal state as regards appetite, evacuations, external temperature of the body, and report the same without delay. If the animal is turned loose after work, he must, after careful inspection of the body, take him to were the grazing is good, see that the drinking water is good and near at hand, and also take care to fetter the elephant carefully and securely, to prevent straying, fighting, &c. He is responsible for the proper adjustment of the harness and arrangement of loads, also that no long continued, undue pressure takes place upon any part; he must be on the look-out and report the first symptoms of fatigue, whether arising from exposure, overwork, overloading, or from failing health. The *oo-si* should have experience of the most approved methods of fettering, catching, subduing, and approaching unruly animals. He should administer all medicines directed to be given, but should not on any pretence whatever be permitted to prescribe or give any drug, unless specially authorized to do so.

The *pai-si* has to attend to the instructions of the *oo-si* and assist him in such manner as may be desired. He is generally employed on cooly work, *i.e.*, collecting fodder, keeping the standings clean. On the march it is his duty to precede the elephant, to explore the route, with a view to the avoidance of quagmires and quicksands, as well as of sharp stumps or stones. This important duty is, however, frequently not carried out efficiently owing to laziness, the *pai-si* riding on the elephant. In the case of timber-working elephants, it is the duty of the *pai-si* to fix the dragging chain on to the logs, and he is then frequently called the *pai-chaik* (ပုခဲ) or the man who "hooks behind." It is in the capacity of *pai-sis* that *oo-sis* serve their apprenticeship. The *gaung* or jemadar, when one is kept, controls the *oo-sis* in the duties above detailed; he should possess superior experience and judgment in the recognition of the more ordinary ailments, also a knowledge of the uses of some of the common drugs, as well as ability to dress wounds, &c., and perform minor operations, such as opening abscesses. All who are directly connected with the care of elephants should be firm, kind, and above all even-tempered, qualities for which they have a ready perception. I have known the training of a previously well-behaved animal to be lost to such a degree that she would endure neither load nor rider, simply owing to the accident of being placed in the charge of an irascible fitful keeper, who first negligently indulged, and then wantonly punished her. A rider who ordinarily shouts out his words of command in a needlessly harsh and loud voice, and who extensively and passionately employs the goad (*see* Fig. 6), is usually of this class. In timber working, many elephants are ruined in this way; hence the danger in changing drivers. The essence of good riding consists in controlling the animal entirely by word of command, and the proper application of the knees and feet when necessary. There is a word in Burmese which describes a good driver as a "knee rider." Elephant-keepers are a peculiar class of men, who require delicate handling, but with a little tact much good can be got out of them. Elephant driving is an art which takes some learning; good men know their value, so must be pampered a little; they are well aware of the fact that most Europeans are ignorant as regards elephants and their management, and are consequently very often a little above themselves. One point in connection with elephants must never be lost sight of, namely, the importance of securing a maximum degree of permanency of the particular attendant of a particular animal. A keeper who is possessed even in a moderate degree of the qualifications already enumerated, and who has been with his elephant a sufficiently long time to have studied the peculiarities of his charge, has become invaluable to his

employer. The knowledge in question can only be gained by experience, and lengthened individual observation; it cannot be placed on record or otherwise handed down; hence any animal placed in the hands of a succession of keepers is subjected to treatment extremely calculated to prove prejudicial to its health, temper, and utility. Much ill success in the maintenance of elephant establishments is to a great extent traceable to this cause; accordingly it will be found expedient to condone much in a good keeper.

The common offence for which mahouts are dismissed is the appropriation to their own use, or sale for their own benefit, of the "*ratibs*" (special allowances, such as flour, rice) allowed by their employers. The best remedy for this is extra supervision and, whenever practicable, to make certain of the animals receiving their full daily allowance by having them fed in the presence of some trusted person. If this cannot be done, flagrant as is dishonesty of this kind, a really good keeper should not be dismissed, unless his peculation is of such a degree as to affect the health of the animal in his charge, thus evincing a lack of concern in its well-being. Petty peculation, submission of false and exorbitant bills for medicines said to have been purchased and given in emergency, and regularly stealing a portion of the "*ratibs*" are drawbacks which, in an elephant establishment, must be regarded as lesser evils. Elephant attendants appear to be unable to abstain from these methods of defrauding their employers, and any attempt to enforce honesty by severe measures would eventually be visited upon the animals, and thus a much greater evil brought about than that which it was sought to avoid. Supervision will ensure the animals receiving the food ordered for them, and, by keeping a supply of ordinary drugs and "*mussaul*" ingredients, the attendants would soon recognize that it was quite unnecessary for them to submit bills for medicine.

As a rule a driver is proud of his elephant, and it is astonishing to see what a good man can make his animal do; all his orders are given in a quiet persuasive manner, and his hints (conveyed by his knees and feet behind the animal's ears) are given in such a quiet way as to make it almost appear that the movements of the elephant are spontaneous.

There are many offences for which keepers should be severely punished, or dismissed, namely, a man who takes no pride in his animal, and shows no concern about its prosperity, evinced by making the immediate wants of the animal subordinate to his own, by cooking his food, sitting down to smoke before he has watered and fed his elephant, by neglecting to bathe it when proper opportunity offered, taking the animal into water when the body is heated, overworking or overloading it, failing to administer medicines.

ordered, and neglecting to report any symptoms of ill health, injuries, &c.

Nevertheless keepers of almost tantamount value with their animals and to their employers are frequently dismissed or discouraged for offences which by comparison with the above are mere bagatelles; often too upon charges not thoroughly enquired into or proved. Much care as may be exercised in the choice of a good keeper, it is singular how little is occasionally bestowed on that of the disposition and attainments of the person empowered to deal summarily with him.

In this province, when elephants are purchased, they are generally in the care of Burman, Karen, or Shan drivers. There is little doubt that in regard to the handling and general management of domestic elephants, they are rarely as good as the Indian mahout, as seen in India, but they are in every respect better than the majority of so-called mahouts met with here, who are readily discerned to be adventurers as far as their pretensions to any previous knowledge or experience of elephants goes. The few Indians employed are generally on Government animals, or those working in yards. There are many excellent keepers amongst the Burmans and Karens; many, however, are careless and lazy, and a few are impatient and at times cruel. As a general rule they are kind, can stand the climate and heavy jungle work, and are usually cheery, willing fellows:—

	Per mensem.	
	Rs.	Rs.
The pay of a <i>gaung</i> or jemadar ranges according to qualifications from	...	20 to 40
The pay of an <i>oo-si</i> or mahout from	...	12 to 18
The pay of a <i>pai-si</i> or <i>cowardie</i> from	...	10 to 12

Burman employers usually supply their men with food, and in addition give them a few rupees monthly.

It is a good plan to give a good mahout a bonus at the end of the year, but I think it would be preferable to give such men a small increase of pay. Increments of pay are thought much more of by these people.

Management.

This comprises diet, natural and artificial, bathing, exposure, shelter, sleep, &c.

Natural fodder.

If an elephant is to be kept in health, it is essential above all things that he be allowed a plentiful supply of good food, otherwise careful management in other respects will be of little or no avail.

Remarks on the subject of fodder apply principally to those animals which are tethered and fed at their standings, namely, animals working in yards, and of course most Government animals. In this province all others have to forage for themselves, that is, when work is finished the mahouts are supposed to take them always to a part of the jungle where good fodder is procurable. The fore-feet are simply hobbled with the cane fetter (ထွန်ဆွဲ, *htoo*) (Fig. 5) which is lashed between the legs with a piece of rope, or when animals are given to straying far, a long chain is sometimes put on a hind-leg, the free portion dragging-behind. In Karenni, Shan States, Siam, and Tenasserim iron locks and fetters are also used. This operation completed, the animals are set free. In order that they may be readily found when required, a bell or large wooden clapper (ခေလှော်, *hka louk*) is suspended from the neck; this in the stillness of the jungle can be heard for a considerable distance. With regard to the plants most appreciated, this can only be studied by observing the fodder usually chosen by wild animals, and this without doubt consists mainly of grasses, tree fodder being of secondary importance. Wild animals wander about a good deal according to the season of the year; at times they keep to the hills, at others they are to be found in the low country; generally speaking they spend the greater part of the day in dense shady jungle, where they rest and browse on the leaves and branches of young trees. They traverse the bamboo tracts, but except when the young shoots are sprouting at the beginning of the rains, or where regeneration of the bamboos has recently taken place, they do not remain very long in these localities. They visit the water morning and evening, and my experience is that when possible, in coming to drink and bathe, they select those places where there are patches of so-called *kaing* grass (ထွန်ဆွဲ) (Hind., *Kussullut*).

It may justly be concluded that the succulent stems of the *kaing* form the most important item of the elephant's daily food, so much so that we may accept it as the staple for animals in captivity, when this grass is procurable, as it is at nearly all times of the year (the months perhaps in which the fires rage being excepted, mid-February to April). So fond are wild elephants of this grass, that I have on several occasions during the rains, when the sky is dull and overcast, known a herd to remain for days in large stretches of it. If wild animals be watched when grazing, it will be observed that, after tearing off a bunch of grass close to the roots, they remove the dirt adhering to the stems by beating it against their legs or sides, after which they simply bite off the lower third which is fresh, sweet, and succulent; tame ones naturally do the same if allowed sufficient fodder to permit of such waste, a rare occurrence. A large margin should always be allowed, as elephants are

given to trampling and soiling a certain amount of their ration ; this they refuse to touch ; if the residue be weighed after an animal has finished his meal, it will be found to be a good slice off the ration ; hence, if only the bare allowance be given, an animal may gradually lose flesh owing to his being half-starved. With regard to grass, then, he should not be stinted. I may state that at least from three hundred and fifty to four hundred pounds of *kaing*, where procurable, freshly cut morning and evening, should be a necessary portion of the daily fodder. The quantity mentioned is a preliminary index to what the average animal will consume. The true criterion as to quantity is, however, not to be sought in any fixed standard such as height, but in the animal's ability to dispose of it during twenty-four hours, presupposing always that the fodder is to his taste, fresh, sweet, clean, and succulent. Some kinds of grass, such as *kyu* (ကျူ) (Hind., *null*) for instance, *myet-thin-dong* (မြတ်သင်္ဃောန်း), and rushes like *wet-la-myet* (ဝေလ္လာမြတ်) may also be given, when it is difficult to procure *kaing* ; most of them, however, are far less appreciated by elephants.

In Rangoon, fodder is usually brought in boats, and consists invariably of *wet-la* (ဝေလ္လာ) and *myet-thin-dong* (မြတ်သင်္ဃောန်း). With reference to the former, it is a poor substitute for *kaing* and probably accounts for a good deal of the indifferent health and reduced capacity for work exhibited by many of the yard elephants (which in my opinion are through ignorance half-starved). In out-stations the animals are sent out to graze or taken out into the jungle, and, when fodder is collected, they carry it into camp. Those in charge must not be led away by the sight of the mahouts bringing in large loads of fodder on their elephant's backs ; nothing short of personal inspection and weighing is satisfactory ; contractors are in most instances quite as bad as mahouts ; every bundle must be opened out and examined and all dirty worthless stuff rejected, such as slimy grass, insect-eaten leaves, and branches and leaves that have been soiled by birds. I know from experience that mahouts are frequently too lazy to obtain good grass, even when it can be procured a mile distant from camp ; this is notably the case when on the march ; they think as long as they can deceive the person in charge by bringing in a load of worthless stuff (which plan often answers their lazy inclinations admirably), their duty is done, and it is a matter of little consequence to them how much or how little the animals may eat. These men, owing to the fact that it is easier to lop off branches than to collect good grass, are fond of reporting that there is no good grass near camp. Every means must be taken to ascertain the truth of such statements, as, though grass may not be plentiful in the immediate vicinity, it may be

abundant only a short distance away. The other varieties of food which elephants consume in their natural state are numerous, such as leaves, bark of trees, palms, canes, creepers, fruits, &c.; even could we ascertain what they all were, it is most unlikely that we could procure them in great abundance for use in the depôts. Branches of certain trees may be given to augment or vary the ordinary grass fodder, and may on emergency replace it. Of those readily procurable may be mentioned the peepul, banian, and other varieties of the *ficus* (which genus is well-represented in Burma), the *sindong-ma-nwe* (*Tinospora nudiflora*), jack tree, young shoots and feathering tops of a great variety of bamboo, palms, paddy, millet, and maize straws, all kinds of grain, growing or dry, sugarcane, plantain leaves and stems, fruits, such as pine-apples, plantains, melons, cane and other jungle fruits, are all much appreciated. Whenever circumstances permit of elephants being set free to graze and choose their own fodder, the opportunity should not be neglected; nothing is more conducive to their health, so much so that enfeebled and diseased animals will more often recover by this practice than by any other treatment.

Other varieties of green fodder may be used, such as—

- | | | |
|--------------------|-------------|--------------------|
| 1. Kussullat | ... ကိုင်း | ... Kaing. |
| 2. Rakhshee, Ghond | ... ဝတ်ထာ | ... Wet-la. |
| 3. Ghut (Eleusine) | | Sin-gno-myet. |
| 4. Nagar Mootha | ... နဂါးထွေ | Myet-thôn-tin-gwa. |
| 5. Null | | Kyu-bin. |
| 6. Peepul | | Nyaung-ni. |
| 7. Goolar | | Tha-hpan-thi. |
| 8. Banss | | Wa-ywet. |
| 9. Kuss, Kusa | | Myet-thin-dôn. |

It has, of course, already been explained in the foregoing pages that whenever *kaing* grass is procurable it should be given in preference to anything else. The daily quantity of green fodder should differ in accordance with the quantity of dry fodder (straws) allowed; yet I can strongly recommend that, whenever practicable, each animal should have as much green grass as it can consume.

Sanderson made numerous experiments with regard to the quantity of the fodder elephants will eat, and gives most interesting information on the subject. He states: "800 lbs. may be looked upon as the *minimum* weight of good fodder that should be placed before full-sized elephants per diem." He has seen a tusker eat 800 lbs. in eighteen hours; he also remarks on the *insufficiency* of the fodder usually placed before them, and I entirely agree with what he says.

It may be said with truth that most grasses, the leaves and branches of many trees, in fact most green stuffs, are acceptable. No amount of grain will compensate for a continued short allowance of fodder. When good fodder is abundant, the extras may be reduced in quantity or entirely dispensed with.

The leaves and branches of the peepul tree (*nyoung-ni*) are reputed to be heating, and should therefore be given sparingly. Plantain stems and leaves are not recommended in cold weather. When dry fodder is given for a short time, such as stems of maize, millet, a change to green fodder will be necessary. Sanderson points out that branches and leaves are best for food when the twigs snap rather than bend under pressure; the branches are not relished when the sap runs. Only the inner bark of the stems of the larger branches is eaten, but the whole of the smaller branches.

Artificial Food.—In so far as the domesticated elephant is in an artificial state, his natural diet must be modified and supplemented, and more particularly so in the case of working elephants. If the animal in his natural condition, in which he develops a very small degree of energy, requires the whole day and the greater portion of the night to feed, whereby he may be able to replace that energy, then, in the domesticated state when a greater consumption of energy is demanded and a reduced time prescribed for the repair of the loss, food must be supplied in a more concentrated form. Whatever the practice of native owners may be to the contrary, common sense, no less than the percentages of mortality among native-owned elephants, points to the propriety of giving working elephants a daily "ratib." The "ratib" may consist of rice, paddy, or coarse flour. Our object is to supply increased nourishment without undue stimulation. Rice fulfils these conditions very well, and gives good enough nutritive results with a minimum expenditure of energy on the "ratib." Twenty to thirty pounds of rice per diem is the "ratib" most in favour, although paddy is also occasionally given either alone or with an equal quantity of rice. If the rice or paddy is coarsely bruised, it is more easily digested. The husk of paddy is believed by many to cause irritation of the bowels, especially when given dry. It may on rare occasions do so. Government elephants when given rice are allowed some paddy straw in which the grain is enclosed in small bundles to prevent waste. This I think is superfluous, as in my experience they do not waste much. Wheaten flour is commonly given in India; it is made up into native cakes or *chupattees*; it may be given in the form of a loaf (cake), which may be sweetened with raw sugar, known as *gur* or *jaggery* (തടിയൂർ), or *mudh* (honey) (വാഴക്കട്ട); dhall (പേടി) and onions (കുന്ദ) when cooked may be incorporated with the loaf. During the hot season tamarind pulp

(ခဲးထွင်းဖွင့်) which acts as a cooling laxative, may also be added. A loaf from three to six pounds in weight, consisting of flour and other needful ingredients, which may be added in lesser proportion, may be given daily when much muscular exertion is demanded. Medicines are sometimes mixed up with the "ratibs" and "mussauls." The best time to give "ratibs" is after some of the ordinary fodder has been consumed.

Aromatic spice balls known in India as "*mussauls*" (မထောထေးထုံး) (see Appendix) are also given occasionally. They consist of a variety of vegetable substances, many aromatic, such as—

Ginger (ဂျင်းပင်း။)	Black pepper (ခရိုင်ကောင်း။)
Assafœtida (အိန်ဒါ။)	Coriander (နံနံစေ့။)
Aniseed (ဝေန်ဝေ၏။)	Cardamoms (ပေါလာစေ့။)
Turmeric (နံ့ခင်း။)	Garlic (ကြက်ထွန်မြို့။)
Carraway seed (ဝေ့ထံ။)	Cloves (ထေးထွင်း။)
Onions (ကြက်ထွန်နီ။)	Nutmeg (ကမ်းပွင့်ထံ။)

and others. These "*mussauls*" are very useful in the hot season, being stimulant to the digestive organs, and thus promoting digestion. The ingredients are usually mixed with clarified butter (*ghi*) (ဝေန်ဒီးထောထောပတ်), jaggery, or honey. As useful as these undoubtedly are, where an indication exists, they should only be used sparingly. The long continued daily administration of these "*mussauls*" tends to blunt the sensitiveness of the digestive organs, creates new wants, and reduces the full natural reactive powers of the system. It is essential that they be given a liberal ration of salt, at least two to three ounces per diem. In fact a "*ratib*" may have to be given merely as a vehicle for the salt in order to establish the habit. Salt greatly assists the assimilative powers and, moreover, is most useful in helping to free the intestines from parasites to which elephants are very subject. Wild elephants in common with other wild animals are frequent visitors to salt-licks, where they eat the earth which is impregnated with natron.

As already noted in a previous paragraph, petty peculation and appropriation of a portion of the "*ratib*" allowed by owners is a crime common to most elephant attendants and is, when the "*ratib*" cannot be given in the presence of a trusted person, one of the great drawbacks to allowing such extra food.

Times of Feeding.—With regard to the time of feeding, elephants should be allowed to feed at all times, except when at work. If ample fresh fodder be brought in morning and evening, and the animal is left alone, then of the twenty-four hours all but four to six will be devoted to munching. When continuous exertion of any kind is demanded, then before and after work are the most appropriate times for supplying fresh fodder,

I have repeatedly observed yard elephants after work waiting for an hour or two for their food. This is a malpractice which cannot be known to employers, for they could not countenance a practice so cruel and one so likely to be damaging to their own interests.

The Commissariat scale of rations for elephants in Bengal, Madras, and Burma is given in Appendix 39, Volume 5, paragraph 1917, Commissariat Transport, and is as follows.

(1) Elephants when not on the line of march will be allowed two ounces of salt and one ounce of oil each. The following are the scales of green or dry fodder, as the case may be, provided that the latter does not consist of straw alone, *i.e.*, without grain in it :—

	Fodder.	
	*Green.	Dry.
	lbs.	lbs.
Large elephants, <i>i.e.</i> , those over 8½ feet in height ...	650	330
Medium-sized, those between 7½ and 8½ feet ...	575	290
Small elephants, those below 7½ feet ...	500	250

* Sugar-cane, green wheat, &c.

(2) When plantain stems, branches of trees, or jungle grass is given, the fodder allowance will be regulated as follows :—

When such fodder is procurable free of charge.			When it has to be paid for.
			lbs.
Large elephants ...	...	1,300	The quantities are not to exceed in value the cost of sugarcane ration calculated at the price current rate.
Medium-sized elephants ...	...	1,150	
Small elephants ...	...	1,000	

(3) The dry fodder is to be issued only when green fodder is not obtainable.

(4) The following is the daily scale of rations for elephants on command :—

On command.	Grain.	Dry.	Green.	Bhusa.	Salt.	Oil.
	lbs.	lbs.	lbs.	lbs.	oz.	oz.
Large elephants ...	15	200	480	...	2	1
Medium-sized elephants ...	15	175	400	...	2	1
Small elephants ...	15	150	320	...	2	1

(5) Elephant attendants will get a special allowance of four annas a day when fodder is to be cut by them, and is provided free of charge. The allowance is admissible when animals are at graze.

(6) Commissariat Transport Officers are authorized to refuse to draw the allowance of four annas per diem for attendants if their elephants are not kept in good condition.

(7) When the cost of the fodder ration for elephants in Cantonments exceeds that of the command scale of rations, elephants in Cantonments should be fed on the latter scale.

(8) The rules in the preceding paragraph do not apply to elephants with heavy batteries, which are allowed rations on the scale, Appendix 38, paragraph 1917.

Appendix 38, paragraph 1917, gives the scale of rations as follows:—

Cattle.	IN CANTONMENT.						ON COM- MAND.		AT GRAZE.		
	Grain.	Fodder.		Bhusa.	Salt.	Oil.	Grain.	Fodder, oil and salt.	Grain.	Oil and salt.	
		Dry.	Green.								
	lbs.	lbs.	lbs.		oz.	oz.	lbs.	lbs.	lbs.		
Ele- phants {	First class	*15	200	480	...	2	1	15	...	15	...
	Second class	*15	150	320	2	1	15	...	15	...

* Atta or rice.

When *dhan* or paddy is given to elephants in lieu of rice or flour, the allowance is to be doubled. When paddy or rice is issued, 10lbs. of grass is allowed per elephant per diem for tying up the grain in small bundles to prevent waste.

As already pointed out, this system of regulating an elephant's food requirements, as shown in the above tables, cannot be satisfactory, as small, thick-set animals often require as much food, if not more, than those of greater stature.

Watering.—If an elephant be bathed morning and evening, and the water be good, he will generally drink the chief portion he requires on those occasions, which amounts to from thirteen to eighteen gallons at a time. If the water available at the bathing place be stagnant, he should be given drinking water from a better source beforehand or be washed outside. Spring or well water is the best. Many ailments are traceable to the use of bad water. Elephants like running water, and prefer to drink the water of tributary streams to

that of the large rivers. At all times the water offered should be as sweet and clean as can be procured, though they are not averse to drinking muddy water (wild ones have little else during the rainy season). During the dry season good water-holes (such as the Burmans dig for their own use) should be dug in the sandy beds of streams; failing these, well water must be given. On no account are they to be permitted to drink from the tanks and pools used by cattle. In their natural state they drink shortly after sunrise and before sunset. Domestic animals ought to be watered at least twice daily, three times when possible, namely, morning, midday, and evening. They should be watered about three quarters of an hour before they are fed. On the march, if any animal attempt to drink, although he be heated, he may be allowed to do so (this does not apply to squirting water over the body). A lengthened hot march (over seven hours) should not be attempted unless water is procurable on the way. When travelling with elephants during the hot season, marches should be regulated in accordance with the prospects of good water-supply.

Bathing and Grooming.—Bathing is one of the natural functions of the elephant, and most important to his health. In the wild state the animals pay daily visits to the deep cool pools in hill streams, and even the large rivers, and immerse their bodies, lashing the water about them, or squirting it over themselves. Inactive as the exhalatory functions of the skin appear to be, dirt speedily produces much irritation, and, continued want of a bath, general indisposition. It is of advantage that the water be deep enough to admit of immersion of the whole body in the crouching position, if not otherwise. They should on no account be kept in places where facilities for bathing fail. They may, when in health, be taken into the water in the early morning, as they appear to possess no sense of chilliness, for, if left to themselves, they will not hesitate to enter water shortly after daybreak. Sunset is the best hour for the evening bath. While bathing, the attendants should rub the body over with a soft stone, or the husk of a cocoa-nut; the animal will squirt water over himself constantly. The natural orifices and feet must be kept clean. When a halt has to be made at a place where no body of water exists, the attendants must draw water from wells and pour it over the animals. Bathing is never to be undertaken when animals are in a heated condition. If a river is encountered on the march, they should be halted and not permitted to enter till their bodies have cooled. When dry, after bathing, it is customary for the attendants to smear oil all over the upper portion of the head, the idea being that it has a very cooling effect and soothes the irritation with which the

scurfy state of the head is so commonly attended. If this part was kept thoroughly clean, and protected from the sun by a pad, this remedial anointing might perhaps be dispensed with. It must be remembered that the application of oil deepens the colour of the skin to a perfect black, thus vastly increasing the capability of the surface for absorption of heat. If a sun pad is necessary under ordinary conditions, it is doubly so after oiling.

Rest and Sleep.—Rest extraordinary comes into question only before and after work extraordinary. Sleep in the case of the elephant is confined to a very few hours; generally speaking from about 11 P.M. to 3 A.M., but often only for a couple of hours. It is of the utmost importance that the animal should have his sleep, such as it is, and this will be interfered with prejudicially if too frequent night marches, or other night work, be required, or if the feeding hours are too often curtailed by long continued work at any period of the day. To keep an animal waiting for his fodder on coming off work is already mentioned as one of the worst offences of which a mahout can be guilty, for by that means the animal's feeding time is wantonly subjected to further diminution, and the opportunity for sleep as well lessened in proportion. If the animal have not time to eat a sufficiency before midnight, it will continue eating all night, supposing that enough fodder has been provided. Care should be taken to see that the standing selected is on a slope, the ground even, free from stones, and that the elephant is allowed plenty of room.

Exercise and Work.—When elephants are idle, it is essential that they have daily exercise, as they frequently fall out of condition from sheer want of it, especially so, if under these circumstances ratibs be allowed. In some cases the daily journey for fodder will suffice. When, however, this is too short, and no work can be found, it will be necessary to give them a march for an hour or so in the early morning and the cool of the evening. In the hot season they should be rested between 10 A.M. and 4 P.M. It is cruel to work them in the heat, and is also dangerous, as they are liable to go down with heat apoplexy. Where there is work, and in a great many instances there is more than the animals kept for it can properly accomplish, the following system may be tried. Assuming that the gear is a good fit, that the parts where it presses are healthy, and the animal in other respects in full health and vigour, it will, as just mentioned, be conducive to the maintenance of both that he should perform a daily task, be it marching, dragging, or pushing. An hour or so morning and evening of continuous exertion, such as the animal can compass without evident strain, is about what might be demanded without giving any extra diet. The question of the

amount of additional work he can do will then resolve itself into that of how many hours taken from his legitimate occupation of munching green fodder can we make reparation for by offering a more generous diet. This is a clear issue, and makes the answer easy. We can by these means assuredly not more than double or treble the duration of the working hours. The healthy elephant with good treatment, liberal allowance of fodder, can work regularly for six or seven hours a day without injury. But the question just answered is, in practice, rarely ever asked. The more common question, which, too, for reasons assignable, we are bound to answer is not, what are the limits of fair work, but what constitutes overwork, particularly in respect to carrying. In a campaign, sometimes these rules cannot be adhered to, for conditions may arise demanding the utmost strain upon the elephant's capabilities. It is useful to know to what degree ordinarily the powers of the elephant may be taxed within twenty-four hours, without depriving ourselves of his services for the next twenty-four hours or longer period. The reply is complicated, and can be given only in the form of an illustrative table; so many are the elements of each problem, so variable may these separate elements be, upon one and the same occasion, as to make the laying down of rigid rules inadvisable. There are to be considered (1) the load; (2) the configuration of the ground over which the road lies; (3) the nature of its surface; (4) the time of day; (5) the existence or absence of shade; (6) the number of days' rest enjoyed immediately before, and in prospect immediately after, the march; (7) the quality and quantity of fodder and water available. From which collectively may be deduced the number of miles the animal can safely traverse. It must never be lost sight of, that the elephant is a nocturnal animal, therefore all work should, as much as possible, be done in the early morning and evening. It must also be borne in mind that in continuous exertion like marching, fatigue comes on almost imperceptibly; we are then more likely to be deceived in measuring the staying power of the elephant than in work of a spasmodic and intermittent kind, such as dragging or pushing timber on the ground. If a log be too heavy, the animal will snort, refuse, or move it but a short way at a time; but, in carrying a load that at the first start off sits easily, the animal becomes exhausted almost unconsciously to himself. After a pause on the march, he is unable to overcome the stiffness that immediately supervenes, and, if he be goaded too much, may drop down suddenly to rise no more. A good attendant will generally give timely notice of the possibility of such an occurrence.

The elephant is by conformation a beast of burden, and, though he goes in draught, he is out of place in it, as it throws him into an

unnatural position, and he loses much of the advantage his size, weight, and strength give him. Elephants are employed for draught in the heavy siege batteries. Opinions vary as to the absolute weight an animal can carry. Of course the greatest weight he can sustain can be moved over short distances only, and medium loads over less space than light ones. I, however, have rarely met a person travelling with elephants not his own, but referred to the loads as "light loading you know," "loads that a cooly could move," and so forth. Under some circumstances it is as much as an elephant can do to move the weight of his own body, not to speak of a heavy load, or a log of timber. Taking the weight of an average animal to be four thousand pounds, or that of about forty Indian coolies, it is obvious that the latter can carry much more over a greater distance than the former. Doubtless the coolies could also drag greater weights if their efforts could be united simultaneously. A cooly can well carry half his own weight, but an elephant could not sustain the weight of twenty men for any time; ten ordinary men, with the indispensable gear, would be a decidedly heavy load.

The Government loads vary from 1,000 to 1,200 lbs., but 1,000 pounds including everything is a comfortable load, and, if elephants are to be worked for any time, it is inadvisable to make them carry even so much.

Appendix A is a table illustrating the manner in which different circumstances should be taken into account in deciding the length to which a march may be extended. It is not the intention to devise a rule whereby to limit the discretion of thoughtful and conscientious servants, who will seldom commit an error of judgment in this direction; but to prepare a key by means of which the careless or uninterested may more readily be brought to book.

As regards dragging in the hills, if about three hours in the morning and three in the evening, and not more, be devoted to work, it will doubtless occur that the number of logs worked out in a season will fall below the average. Figures quoted with reference to this heading can have but little general application; local circumstances, such as the configuration of the ground, the distribution of the logs, and of the floating streams, will decide. A few facts may nevertheless be interesting. Two hundred logs, say, two hundred and fifty tons per animal, dragged *ex situ* to the floating streams in the course of the season, may be regarded as an exceptionally favourable figure. It could not be accomplished except in a district newly opened up, where dead trees were still standing in considerable numbers in proximity to the streams. But, taking Burma jungles in their ordinary form, an elephant might have to drag the logs some miles to the streams and would probably die before he

collected half that amount. In some cases the hill streams are fit for floating timber, and the work is about a third less than in others, where a second land journey has to be made from the confines of the hills, through the plain to the point where the stream becomes suitable for floating. The principal and the most trying part of the dragging work, namely, that of the isolated trees from their original sites, up and down hill to the preliminary depôts, should be undertaken in the cold-weather months, when the deepest leaf covering is on the ground, which, moistened by heavy dews, allows the logs to slide more easily.

A small dragging cart (Fig. 36) has been employed with profit even in the hills, and there is little doubt that, by bringing thought to bear on improving such appliances, and placing less reliance on sheer brute force, elephant labour might be economized (*see* Figs. 36a and 36b) both in regard to the number of animals needed and the strain placed upon the powers of each.

Before and after work it is necessary to inspect all parts liable to gall, and, if the animal has been carrying a load, the attendant should shampoo the back with his feet and hands. The trunk and feet should be carefully examined for cuts, bruises, and foreign bodies, such as thorns, bamboo spikes, and during the rains the body for leeches, which are very plentiful in some parts of the province, the bites from which at times cause nasty sores.

Powers of endurance.—Though such large animals, their power of endurance is much less than is generally supposed, as they are constitutionally delicate. Through lack of appreciation of this fact, these animals have not received the attention they justly deserve; and owing to the popular impression that they are extremely strong, the error obtaining in this respect has led to their being too highly tasked, and much of the ill-health and mortality prevalent amongst them may in a great measure be attributed to this cause. The smaller kinds of animals employed for transport are born and bred in captivity, and have thus by custom, training, and other causes become more or less inured to hardships, but with elephants the case is entirely different; here, we have animals that have lived a natural life for many years, when one day (unfortunately for themselves) they are surrounded in their native haunts and captured. Soon after capture they are trained, put to work, frequently overworked, often neglected, and altogether submitted to conditions in every way foreign to their nature and well-being. It should not be a matter of surprise that the mortality runs high. Therefore, it cannot be too forcibly impressed on the persons entrusted with their care, that untiring and vigilant supervision over the attendants,

not merely giving orders but seeing them carried out whenever circumstances permit, is the means above all others for the proper preservation of the efficiency of the animals ; they must remember that the class of men usually attending the elephants, if left to themselves, are, from general indolence, carelessness, or from a desire to avoid the fatigue and hardships of jungle-life, or a campaign, quite liable to render their elephants unserviceable ; ample supervision, and systematic checks can alone prevent malpractices. A little neglect will often deprive an owner or a force of the valuable services of many animals.

As regards elephants employed in forest operations in Burma, the life of the elephant is frequently the only security capitalists have against advances made for timber to be worked through their aid. The percentage of deaths that annually occur amongst elephants employed in this branch of industry is probably from ten to twenty per cent. Not an inconsiderable number of such deaths are due to over-exertion and exposure, and ignorance on the part of native owners as to the powers of endurance of an animal and their inability to detect the first symptoms of exhaustion ; while in many instances they attempt to exact from a poor beast the last effort of strength it is capable of exerting. With reference to timber-dragging operations in Burma and Siam, the duration of daily employment naturally varies with the time of year, physical aspect of the country, and the food and water-supply. In timber-yards in Rangoon and Moulmein, where elephants are much exposed to the sun, they usually work from three to four hours in the morning and three hours in the afternoon. In forests, where the shade of the trees afford shelter from the direct rays of the sun, and where the country is not too hilly, or the drag too heavy, the hours of work generally extend from about seven or eight o'clock in the morning till three o'clock in the afternoon during the working season, *i.e.*, from about the month of June to the middle or end of February. During the hot season the animals are allowed to rest, or at most they may be employed for a couple of hours in the morning in shady places and where good water and grazing are at hand, so that on being released from work they can be set free to eat to their heart's desire. In all such matters, however, it only requires common-sense and a little intelligent supervision to soon be in a position to ascertain the powers of endurance of each animal one may have to deal with, as these powers vary in individual elephants as much as in human beings, except that, in the former case, when once an animal's strength is overtaxed, the evil is less readily remedied owing to the difficulty of treatment.

Paces.—The only pace of the elephant is a walk, any increased pace he may put on is a fast shuffle. He can neither trot, canter, nor gallop.

Exposure.—As already observed, the elephant is by nature a nocturnal animal, and is therefore most impatient of the sun. He appears to be more himself during the night, and in the mornings and evenings than during the day, even when protected by shade; at these times he is more active, and can in every way perform more work. Animals tethered in the sun will show their dislike to it by heaping bundles of fodder, blankets, in fact anything that will afford protection on to their heads, and constantly kick up sand which they collect, and throw on their heads and backs. When working in the heat they frequently place the trunk in the mouth, and squirt watery fluid over their bodies. Perhaps no elephants are exposed more to the sun and weather than those working in timber-yards, where they are at work from early morning till eleven o'clock and again from 1 or 2 P.M. to 5 P.M. The work, however, varies, sometimes light, at others heavy; occasionally they get a rest, owing either to there being no work, or to some part of the mill machinery having given way. It is possibly owing to the frequency of these rests, the variation of the work, and the extras in the way of food they receive, that they stand it longer than might be expected; but on the whole the mortality is high. If the animals are picketed out during the hot season, when the glare is very great, it is advisable to hang moist cloths or shades over the eyes: It is also desirable that elephants working in the sun be provided with a pad of material similar to the guddeela, or of a lighter material, say, cotton, large enough to cover the neck and head and hang down a span or two around the latter. A careful attendant will often be seen spreading his turban or jacket over his animal's head to shield it from the sun. Exposure to rain, and even having to dispense with other shelter than that of a tree, provided the drainage be good, does not seem to act prejudicially. On the other hand, exposure to cold night winds in open sheds erected upon bare, unsheltered and elevated sites, which again become heated to a proportionate degree during the day, has been justly regarded as a source of disease. Artificial shelter is required only where good natural shelter fails. The best shelter is a grove of evergreen trees, standing on a slight slope, where the drainage is good, and so large as to permit of the standings being frequently changed. But for elephants working in yards, sheds have to be built. They should be erected on sheltered and well drained sites, and ought to be provided with jhamps on the north-east and south-west sides, and have raised, hard, sloping floors of concrete or laterite. Floors made of

slabs of wood are objectionable, as urine, &c., runs down between the boards, thus saturating the soil beneath. Several short stout posts with or without ring-bolts should be planted firmly within and without for the purpose of tethering the animals. Quarters should also be provided for the attendants in connection with the sheds in order to remove any excuse for absence from their respective animals.

Elephants are often kept in stations without their presence being turned to good account, and where facilities, not only for obtaining their natural fodder and for bathing, but natural shelter also fail. Much sickness, mortality, as well as current outlay, would be done away with were the elephant depôts to be moved to the nearest place which offered natural advantages for the keep of the animals. Some localities have been observed to be very badly suited for the keep of elephants, in which nevertheless their services are required for sorting timber, &c. Such places will generally be found to be of a kind varying to the furthest extent from the conditions in which we meet with elephants in their natural state. Perhaps none are more objectionable than the daily inundated tidal marsh lands, where the sheds are situated on patches of ground which barely escape inundation.

In selecting camping-grounds it is essential that the ground be sloping, the elephants should face with heads uphill, otherwise if they lie down they might experience much difficulty in rising; care should also be taken to see that the standings are not on uneven ground, and that they are free from stones and stumps.

All dung, litter, &c., should be removed morning and evening to a considerable distance from any standing.

Gear.

For timber-dragging, the harness in most general use consists of numdah, saddle, girths, back sling, and chains, and to describe them in order we will take first the numdah:—

This consists usually of the dressed bark of the *bambwè* tree ഓട്രംകൊട (*Careya arborea*) in pads of about 3 by 4 inches in size. The bark is stripped from the tree in one piece, and prepared for use by beating it with some heavy instrument sufficiently to loosen the fibre, without shredding it altogether, as with coir. If properly prepared, a piece of *bambwè* so treated is made as soft and pliable as jute, and very seldom causes a chafe. The bark itself has also astringent properties,

which are cooling and hardening to the skin on which it is directly laid. There are other barks used, namely, *shaw* ချေ (*Sterculia ornata, versicolor and villosa*), all prepared in much the same way ; but the first mentioned is more generally used. Over the bark is spread a green hide or two, on which are placed the *ohn-dones*.

Saddles or ohn-dones (ခရီးခရီး), see Fig. 13.—These are pieces of any light wood, about 18 inches by 4 inches by 4 inches hollowed out roughly to decrease the weight. They are connected by ties (12 inches to 18 inches) and of sufficient length to allow them to rest on each side of the spine, and high enough to remove pressure from the backbone itself, when the slings are in place.

Another variety of saddle in common use called a *kwe-chee* (ကျွဲကြီး) is a light frame-work, and it appears to be a matter of opinion, not unmixed with a good deal of feeling with the workers of elephants, as to which kind of saddle is the more comfortable for the animal.

Girths and sling.—The *ohn-dones* being in place, are girthed on with a belly-band of woven *shaw* about 2 inches broad, and 15 fifteen feet in length, the sling or *gök-see* (ဂုတ်ခွေး) is next adjusted. This, too, is made of *shaw*-rope about $2\frac{1}{2}$ inches in circumference, and is of such a length that when doubled and laid over the back, the two loops hang down the shoulders to a height rather above the level of the chest. Through these loops the ends of the breast-straps are passed, and as the use of the *gök-see* is mainly to keep the strap in position on the breast without any undue downward strain on the spine, it requires more or less adjustment for each elephant.

The *breast-strap*, which after the chain is the most important part of the harness, is made of finely shredded *shaw* twisted up in two strands, each about the diameter of an ordinary walking-stick, and woven on a rough loom. The strap is about 5 inches in breadth, and finished off at each end in a loop, into which iron eye-lets are fitted. The length varies for different elephants ; it should be just sufficiently long to go round the chest and pass through the loops of the *gök-see* clear of the shoulders, so that the chain when hooked on, and in use, does not interfere with the free action of the shoulders. The breast-strap before use is softened with fat ; and as the elephant's breast is well greased before work the strap

soon absorbs enough fat to make it soft and pliable. This strap, however, even with care, only lasts from three weeks to a month. The mahouts make the breast-straps for their animals, and usually keep a fair stock.

Chains.—For tuskers $\frac{5}{8}$ -inch, and for females $\frac{1}{2}$ -inch rubble chain is generally used. The chains are fastened to the breast-straps by means of large hooks, or by a swivel-link, locked across the loop of the breast-strap. The chain consists of two traces, one 14 feet long, and the other 8 feet (to take an average measurement). At the working end of the longer chain is a link sufficiently small to pass through the drag-hole of the log and hook on to the short trace, which is fitted with a strong stub-hook. It not infrequently happens that even the larger-sized chains part under a heavy pull, and accidents, though frequent, are not, as one might suppose, serious. It is rarely that any injury beyond an abrasion results to the elephant; and the driver is provided with a strap from the saddle with which to hold on at critical moments.

The foregoing is sufficient harness for an ordinary well-trained elephant; but it is occasionally necessary to supplement the gear with backing chains and a crupper made of plaited cane for animals given to jibbing and other tricks.

Other articles of elephant's equipment are fetters, *soolay*, and foot-chain. The latter two are seldom used, except on runaway beasts and confirmed bolters; they are only removed to be changed occasionally from one fore-foot to another. The foot-chain alone is used in dry country, when the mahout would have difficulty in picking up his elephant's tracks, and for animals given to wandering or straying. In such cases 40 feet of $\frac{3}{8}$ -inch chain is tied to the fetter between the fore-legs, and allowed to trail.

Pack-gear.

This is a most important subject and cannot receive too careful attention. Unless the gear fits properly and is carefully adjusted galls are likely to result and thus incapacitate animals often for lengthened periods. This may be a matter of the utmost importance, for instance, when such animals are employed for transport in warfare.

Different patterns have been devised from time to time, but there is only one which can be recommended, and that is what is known as "Sanderson's improved pattern," and which is the pattern adopted by Government. The subject of gear has been ably and fully treated of in a Government pamphlet, edited by this well-known authority on all matters concerning the elephant, entitled "Pack-Gear for Elephants," published by the Superintendent, Government Printing, Calcutta, and which I would advise anyone employing Sanderson's gear to obtain. My remarks are chiefly quoted from this work.

The gear consists of the following parts:—

						lbs.
Guddela	...	...	...	...	...	45
Guddee	...	...	...	...	...	100
Iron saddle	...	...	...	...	...	60
Girth, complete	...	...	...	...	...	20
Neck-rope	...	...	...	...	...	4
Crupper rope	...	...	...	...	...	2
Iron pipe crupper	...	...	...	...	...	5
						<hr/>
				Total	...	236

- (a) The "*guddela*" is a pad usually made up of layers of soft numdah sewn together and covered with cloth and is placed next to the body to protect it from abrasion, and is about 4 inches in thickness.
- (b) The "*guddee*" (Fig. 14) is a reed-stuffed pad, placed on the *guddela*, and is furnished with a longitudinal opening to receive the spine and protect it from pressure and friction.
- (c) The iron "*saddle*" (Fig. 15), which may or may not be employed, according to the nature of the load.
- (d) The "*girth*" is a stout woven belt of tarred seizing-line, and a light chain for re-tightening. To the D of the girth a cord is attached, which is passed through a pulley shackle at the top of the chain, and by which the girth can be hauled up when slack; the D is then hooked into any required link of the chain, a short rope attached to the top ring connects the girth with the bobbins of the saddle. Tight-girthing is essential to prevent the gear from slipping and the load from swaying.
- (e) "*Neck-rope*" (Fig. 16) is furnished with a loop at one end and is partly covered with leather, which, I think, should be under-sewn, not over-sewn, as usually is the case. This rope affords fore and aft play of the load.

(f) The "*crupper rope*" (Fig. 17) is also furnished with a loop at one end, both of these ropes are secured to rings on the saddle or tags on the guddee, and can be re-tightened as required.

(g) The "*crupper*" (Fig. 18) is a piece of bent iron pipe through which the crupper rope is passed.

I would urge that all gear be obtained as directed by Sanderson, as follows:—

Iron saddles and crupper pipes from the Alipore Jail, Calcutta.

Guddelas, guddees, neck and crupper ropes from Superintendent, Kheddahs, Dacca, or the Harness and Saddlery Factory, Cawnpore. Girths from the Presidency Jail, Calcutta, as they have been manufactured at these places for some time, and been found to fulfil all requirements. Moreover, I may add that they are constructed of such excellent material that their durability far exceeds any other that I am acquainted with.

The gear is made in six sizes to suit animals of different heights, and the guddee may be obtained stuffed or empty. Therefore it is only necessary to state vertical height at the shoulder when ordering it—

					Ft. in.	Ft. in.
I	...	...	...	...	9=0	to 9=5
II	...	...	...	...	8=6	to 8=11
III	...	...	...	...	8=0	to 8=5
IV	...	...	...	...	7=6	to 7=11
V	...	...	...	...	7=0	to 7=5
VI	...	...	...	...	6=6	to 6=11

Prices are as follows, as obtainable in Dacca or Calcutta—

					Rs.	A.	P.
Guddela	...	...	...	...	23	7	1
Guddee unstuffed	...	...	...	...	4	15	11
Iron saddle	...	...	...	...	18	8	0
Plaited girth with appliances	...	...	...	...	4	8	0
Neck-rope	...	...	...	...	0	11	0
Crupper-rope	...	...	...	...	0	6	0
One and a quarter-inch iron crupper, 30" long	...	...	...	...	1	8	0
Total	...	...	...	...	54	0	0

The guddee rope, lashings of girth, neck, and crupper ropes require renewing annually.

A guddela lasts four years with two renewals of cloth.

Saddle, D's, pulley-chains, crupper, &c., will last ten years, and the girth-webbing three years.

This gear must be frequently inspected, that is, at least twice a week ordinarily, and when on line of march daily.

Guddela.—The chief points to attend to are the stitching of the covering-cloth and leather chafing-pieces.

Guddee.—If thoroughly stuffed, and a guddee cannot be too tightly stuffed; examine the underside for lumps and see that rope tags and cross bands are securely sewn on and that the seams have not given way.

Saddle.—Wrapping of lower bars and netting between upper bars should be tight. The bolts at the end of pipes must be kept tight.

Girth.—If any fraying of the web of girth occurs it should be stitched with twine. It must always be kept soft with some lubricant. Neck-rope may become loose and must be relaid.

Instructions for Saddling.—The elephant having assumed a kneeling posture the guddela, and afterwards the guddee, is placed on the back. With many animals these have an inclination to move backwards and forwards so that the guddee works beyond the guddela and abrasions are thus likely to result. A careful mahout knows his animal's peculiarity, and makes allowance for this when putting on the gear. Constant attention must be given on the march to see that they retain their relative positions.

Saddle.—The lower side-bars should be wrapped with soft rope to prevent chafing of the load and girth-ropes, and a net-work of rope should be woven between the upper bars to prevent small articles falling through.

It is placed on the guddee with the bobbin-end in front, and must occupy a medium position on the back.

Girth must be doubled, and the centre marked off with chalk which mark must be placed at the middle of the belly while adjusting. Correct the length of the webbing by holding chalk-mark in position. If correct it should allow the iron D's to clear the fore-limbs in action, but not to come so high that the pulleys may fall on to the guddee. If the webbing is too long, or short, correct accordingly, then hook the D's of the girth on to the lowest ring of the chains on each side. Tighten the girth so that the rings may come nearly home to the bobbins on the saddle, and see that the positions on different parts correspond on both sides.

Fasten one of the short ropes attached to the rings to the near or left-side bobbin of saddle, carrying it two or three times between bobbin and ring and secure, leaving the ring about 9 inches from the bobbin; lash up the other ring-rope as on near side, to off or right-side bobbin and ring, and haul quite tight.

This is done by the mahout who stands on the guddee. Now loosen the near side ring-rope, pull the girth as tight as possible, and make fast. If properly adjusted both the rings should be nearly home to the bobbins, the pulleys clear of the guddee, and the girth throughout quite tight. Lashings may require to be slightly shortened in a few days when the gear settles.

To re-tighten girth on the march.—Pull it up equally and alternately on each side by the ropes attached to the D's and link higher into chains, then pull D rope under the hooks on D's and wrap round chains, or neck, or crupper ropes. The chains should invariably be put back to their bottom links at next starting.

Neck-ropes.—Loop into one of the front corner rings of saddle, carry round neck and with the elephant's head raised pull as tight as possible through the other ring, and knot.

Crupper-rope.—Pass through crupper pipe, secure into rear corner ring of saddle like *neck-rope*, make very short when descending hills or the elephant's withers may be galled.

Care of gear.

Guddele must be dried after being wetted by hanging it with its length parallel with the ground. It should be rolled up at night to keep from damp, white-ants.

Guddee should always be lifted off, not thrown off, as is usually done, as this not only tends to shift the stuffing but strains the sewing. It should be stood on end till required. Girths, neck, and crupper ropes should be placed where they cannot become wet or soiled.

If as a matter of routine each part of the gear is always kept in its appointed place near each animal, sets will not become mixed and the attendants will know exactly where to lay hands on them at a moment's notice. The excellence of this pattern gear which is the result of many years' experience and labour on the part of the late G. P. Sanderson, I can fully testify to, but my experience in this country with ordinary mahouts has taught me to discard the iron saddle when working in hilly country, as I found it next to impossible to have the loads so secured as to prevent some backward and forward play. Another fault necessary to look out for and punish severely is, the habit that some careless mahouts have of placing chains, &c., when not in use, on the spine in the trough caused by the opening in the guddee after it is placed on the back and which is purposely made to prevent weight and friction on the spine. The Burmans, Shans, Karens employ baskets of various sizes and pattern for carrying purposes (*see* Figs. 19 and 20). They are cheap and easily repaired, but quite unsuitable for military purposes.

Miscellaneous: Runaway elephants.

In Burma tame animals are constantly escaping and joining wild herds. It is therefore well to know the law on the subject, as the

question of ownership of such animals has often been raised in India. The following case is quoted from Sanderson : " The following is a case on appeal decided in the High Court of Judicature, Calcutta, in favour of the Government establishment that re-captured an escaped elephant.

" Plaintiff, a zemindar, alleged that he had the female elephant in question in possession for six years, when she fled to the jungles. He made diligent search for her, and reported her loss at the nearest district police-station. He heard a year later that she had been re-captured in the Sylhet district in the Government kheddahs. His claim to the animal being rejected by the Superintendent of Kheddahs, he instituted a suit for her recovery in the Court of the Collector of Sylhet. The Collector gave judgment in favour of the Superintendent of Kheddahs on behalf of Government. Plaintiff thereupon appealed to the High Court of Judicature, Calcutta, but his appeal was dismissed on the grounds that such animals being originally *feræ naturæ* are no longer the property of man than while they continue in his keeping. If at any time they regain their natural liberty, his property ceases, unless they have *animus revertendi* which is only to be known by their usual custom of returning or, unless instantly pursued by their owner, for during such pursuit his property remains. In this case pursuit had ceased, and the animal had returned to its natural and independent state."

Grazing.

When elephants are set free to graze, during the day or night, care should be taken to have each animal properly fettered, more particularly the males, as it not only prevents them wandering away for miles, but may interfere with the males fighting, as they are apt to do at times goring each other seriously. An unfettered small male has a great advantage over a much larger fettered opponent ; and cases have occurred of elephants dying from the effects of such conflicts. In the case of a fight between two elephants belonging to different owners, one being fettered, the other free, the owner of the former received a decree in Court for all the damage done to his animal by the unfettered one. The degree of injury done by goring depends naturally on the length, thickness, and sharpness of the tusks. Sharp tusks will readily pierce the tissues, inflicting terrible wounds ; but blunt ones, whether from pushing timber, or from being intentionally cut, will in many cases cause contusions only, the effects of which, however, may be of a very serious nature. A

case recently tried in Upper Burma will prove of interest to owners of elephants. I therefore give it in full from the Burma Law Reports, Volume VII, Part II, page 73, 1901.

“ Civil Second Appeal No. 25 of 1900, May 7th, 1900.

Before the Judicial Commissioner, Upper Burma.

MAUNG KYAW DUN, *Applicant*. v. (1) MA KYIN, (2) NARAYANAN CHETTY, *Respondents*.

Injury caused by animal, tame or wild—Injury due to owner's negligence—Liability for—Proof of negligence—Proof of *scienter*—Necessity for.

A man should be liable for injury caused by his animal, whether tame or wild, if it is proved that the injury was due to the owner's negligence.

Maung Gyi v. Po To (1) approved.

In that view it would not be necessary to draw a distinction between wild and domestic animals. The point for decision would be whether the owner was guilty of negligence or whether he used such care as in the circumstances of the case was reasonable and ordinarily sufficient. The amount of care required would vary according to the class of the animal and according to its own disposition. It would not be laid down in this country that a man is liable for any damage done by his elephant without any proof of negligence or that he knew it to be of a vicious disposition. In view of the manner in, and extent to, which elephants are employed in this country, such a proposition would be manifestly unjust—*Filburn v. People's Palace Company* (2) distinguished.

“ In the present case it was for the plaintiff to prove that the damage done to his elephant was caused or rendered possible by the defendant's negligence. In considering the question of negligence, the defendant's knowledge or want of knowledge that her elephant was of a vicious disposition would be an important point. In a suit of this kind, where an animal like an elephant is concerned, the burden of proving negligence is in the first place on the plaintiff who avers it. It might be otherwise if the injury by a tiger or a bear were concerned.

“ *White, J.*—The plaintiff-appellant sued to recover damages on account of the death of his elephant, ‘Do,’ which died from the effect of wounds inflicted by the respondent's elephant ‘Kya Gyi.’

“ The issues which arise in a case of this kind have been stated in two cases of this Court. In *Maung Gyi v. Po To* (1) it was observed that the issue generally would no doubt be the usual issue as to the existence of negligence on the part of the owner of the animal doing the damage. In *Maung Swa v. Maung Kyaw* (3) points which arise in a case very similar to the present were indicated. There has been some argument in this Court on the application of the doctrine of *scienter*. It is said that ‘any one who keeps a wild animal, as a tiger or bear, which escapes and does damage, is liable without any proof of notice of the animal's ferocity; but where the damage is done by a domestic animal, the plaintiff must show that the defendant knew the animal was accustomed to do mischief (4).’ Again a person keeping a mischievous animal with knowledge of its propensities

'is bound to keep it secure at his peril. If it escapes and does mischief, he is liable without proof of negligence, neither is proof required that he knew the animal to be mischievous, or if it is a notoriously fierce or mischievous species (5).' In Smith's leading cases, in the notes on *Fletcher v. Rylands* (6) it is said :—

'The law of England recognizes two distinct classes of animals: The first class consists of such animals as sheep, horses, oxen, and dogs, which the law assumes not to be of a dangerous nature, and a person who keeps an animal of this class is not liable for any damage it may do, when not trespassing, unless he knew that it was in fact dangerous. The other class consists of animals which have not been shown by experience to be harmless by nature; and one who keeps animals of this class must prevent them from doing injury under any circumstances, unless the person to whom it is done brings it on himself.'

In the English case on which these remarks are based, namely, *Filburn v. People's Palace Company* (2), it was held that an elephant 'did not belong to a class which, according to the experience of mankind, is not dangerous to man, and therefore the owner kept such an animal at his own risk, and his liability for damage done by it was not affected by his ignorance of its dangerous character.'

"I understand the remarks of my learned predecessor in *Maung Gyi v. Po To* (1) above cited to go no further than to suggest that a man should be liable for injury caused by his animal, whether tame or wild, if it is proved that the injury was due to the owner's negligence. In that view, it would not be necessary to draw a distinction between wild and domestic animals. The point for decision would be whether the owner was guilty of negligence or whether he used such care as in the circumstances of the case was reasonable and ordinarily sufficient. The amount of care required would vary according to the class of the animal and according to its known disposition. It could not, I think, be laid down in this country that a man is liable for any damage done by his elephant without any proof of negligence, or that he knew it to be of a vicious disposition. In view of the manner in, and extent to, which elephants are employed in this country, such a proposition would be manifestly unjust.

"In the present case, therefore, I think it was for the plaintiff to prove that the damage done to his elephant was caused, or rendered possible, by the defendant's negligence. In considering the question of negligence, the defendant's knowledge or want of knowledge that the elephant was of a vicious disposition would be an important point. In a suit of this kind, where an animal like an elephant is concerned, I think the burden of proving negligence is in the first place on the plaintiff who avers it. It might be otherwise if injury by a tiger or bear were concerned.

"I agree with the Lower Courts in thinking that it is not proved that the defendant knew that the elephant 'Kya Gyi' was of a vicious disposition. It was not therefore incumbent on her to take more than ordinary precautions with him. It does not seem to be shown that ordinary precautions were neglected. It is alleged that 'Kya Gyi' twice gored the deceased elephant 'Do,' and the mahout called by the plaintiff declares that he had neither bell nor fetters. On the other hand, as pointed out in the judgment of the Court of First Instance, the plaintiff himself admitted that 'Kya Gyi' had a bell and fetters on the second occasion. It is admitted that all the other elephants of the defendant had bells and fetters; there is direct

evidence, at least as good as that for the plaintiff, that 'Kya Gyi' was properly provided with them. In my opinion it has not been proved that there was any negligence on the part of the defendant and any *prima facie* case made out by the plaintiff has been rebutted. I therefore hold that the Lower Courts have rightly decided that the defendants are not liable; and I dismiss this appeal with costs."

Quicksands.

If an elephant, for want of being preceded by an attendant to explore the route, should chance to get into a bad quicksand or quagmire, the best plan is to throw him large billets of wood or branches of trees, which he can work down under his feet, until he has obtained a sufficiently strong footing to extricate himself. On such occasions it is dangerous to approach within reach of his trunk, as he will seize every object he can for the purpose just stated. It may even be necessary to sacrifice the load.

Mounting.

In order to mount an animal that is nervous of his keeper, which will sometimes happen, if it be in dread of a wound being handled, or dressed, or other cause, a good plan is to throw a rope over the body, making a running noose, and haul it tight round the belly, whereby to climb up.

Crossing Rivers.

The impropriety of taking an elephant into water, whether for fording or other purpose, or permitting him to squirt water over the body when heated, has already been noted; a number of serious ailments, of which cramp is not the least formidable, may follow the disregard of this precaution. Before crossing a river, if the animals be heated, they should be halted, allowed to cool and have their gear removed. A good landing-place on the opposite bank should be selected, and, if the river is wide or moderately so, and be in flood, due allowance must be made for current. It is always a good plan to send in a well-trained animal with an intelligent driver to lead the way, the remaining elephants should be sent in batches of twos or threes. A rope should be tied round the neck, or round the girth, and a second rope attached, the free end of which the mahout can hold when the animal is in deep water. If the elephants have had

a longish swim, or a stiff current to contend against, they should be allowed a short rest. With an unruly animal I found the plan recommended by Steel answer well, namely, to put the troublesome elephant between two quiet animals, and to tie them neck to neck; the attendant should carry a knife in case it may be necessary to cut the rope. In rivers where the fords are not well known, a quiet elephant and a good swimmer with an intelligent driver should be first sent across to explore the route. Elephants are good and powerful swimmers. In deep water the driver should stand, as the animals are fond of ducking themselves.

Bolting.

This is one of the most dangerous but fortunately rare vices of the elephant. It is nearly always the result of fear. Small animals such as fox-terriers are particularly distasteful to them and, ridiculous as it may appear, often cause them to bolt. On one occasion in the Shan States I saw a tusker carrying my kit suddenly run away trumpeting, the only cause I could assign was that a couple of cackling hens ran out close to him from under a hut. In the open it is poor fun being on the back of a runaway elephant, but in jungle, it is needless to remark, a very serious matter. Blind-folding with a cloth often answers in checking their flight, but all animals known to be liable to bolt, should have a fairly long heavy chain attached to a hind leg; the free end should be attached to the saddle within easy reach of the driver, so that if occasion arises he can release it in the hope that it may be caught in some bush or stump. Sanderson cured a bolter by having a hoop of iron made with sharp spikes to encircle a hind leg, *kya-pasat* (ကျာပာဆတ်) of the Burmese (see Figs. 2 and 3). This was kept in position round the leg by being suspended from the pad by a rope, and it fitted the leg so loosely as not to inconvenience the elephant, except when required. To the ring was attached a chain fifteen feet long, at the other end of which was a pick-axe head. This grappling-iron was slung to the pad by a cord in a slip-knot, handy to the mahout who could set the anchor free with a pull at the cord. In the Karen Hills I noticed that unruly beasts and those given to bolting, generally have a hole about the size of a rupee pierced through the lobe of one ear. A piece of cord is passed through the hole, and the free ends kept handy by the driver. On giving trouble the driver hangs on to the string; the method appears to be fairly effective. The *oo-sis* when bringing certain animals in from grazing, pass a cord through the hole in the ear, take hold of the free ends.

and lead the animals into camp. A method employed in Siam with nervous elephants is very effective: A bent hook like a magnified fish-hook hangs loosely on the ear close to the head, a string is attached to the hole on the straight end. When the animal is nervous and shows signs of wanting to bolt, the cooly pulls on the string.

Some mahouts take the trouble to teach their elephants certain methods by which they alone can approach and catch their animals, when out grazing. For instance, a driver seeing his elephant, hails him, upon which the animal at once charges down on his keeper with (to a stranger) apparently alarming intent, but having done this, he permits himself to be caught.

Other elephants will permit their fetters to be removed from the near or off-side only, and some will only allow approach from behind; or the driver must pass under the elephant's uplifted trunk, before he proceeds to remove a fetter.

These little eccentricities are useful in a way, in that they help to prevent a casual thief, or a professional, who has perhaps not had an opportunity of studying the habits of certain animals he desires to steal from capturing them.

Restraint.

For this purpose fetters, chains, and ropes are employed.

Fetters are of various patterns, those most commonly used consist of short lengths of chain. A fetter is carried for each foot, the fore-fetters are connected by a short chain like hand-cuffs, and those for the hind-legs are also joined in a similar manner (*see* Fig. 4). The fetters are fastened by means of a special link-hook. Some elephants can undo this fastening; in such cases a peculiar spring lock of native pattern is applied to fasten the fetter. Many foresters employ these locks when they let their animals free in the jungle to prevent their being stolen.

Fetters made of plaited cane are those generally employed by the Burmese. The fetter is a simple hoop of plaited cane (*see* Fig. 5); when in position, it is lashed between the legs with a rope or thong.

Special fetters are sometimes used such as the *kya-pazat* (ကျားဝှံ) tiger's-mouth; this consists of three pieces of iron, jointed and fitted with spikes on the inside; the hind fetter consists of two pieces of iron jointed and spiked; they are only used on unruly beasts, or when there is a chance of animals stampeding through fear, or on those given to bolting.

Tethering chains are of variable lengths and thickness ; they are usually fitted with a stout iron ring at one end.

Tethering.—Elephants are often secured by one fore-limb only, both fetters are passed through the ring of the tethering chain, after which they are applied to one of the fore-legs ; this method allows the animal plenty of freedom. Where space does not permit or when other elephants are near by, the hind-fetters are put on in a similar manner to the fore, and the tethering chain secured to a post or tree behind.

When "*musth*" is anticipated extra precautions are taken ; the fore-fetters are applied, one to each limb, and a tethering chain runs from each to a tree or post, so with the hind-legs ; and in animals known to be vicious when *musth*, for extra security they often have their fore-legs brought close together, and a long rope is then passed round the limbs above the fetters in a figure of 8, and secured between the limbs. Sometimes only one hind-leg is secured, in which case a rope is wound round the leg about half-way up and tied, the tethering chain is applied above this. For animals given to trying to throw the mahouts off an iron spiked chain collar is sometimes employed.

To secure for operations.

As a rule elephants are very good about being operated on ; they do not appear to mind being cut ; there are, however, many troublesome, dangerous beasts who require to be carefully secured.

The two more common methods employed are as follows :—

- (a) The mahout should bring the animal up to a post or tree, the fore and hind fetters and tethering chains are applied, the hind chain is tied to a post or tree behind, the animal is then made to bring his fore-legs as near as possible to the post round which the fore tethering chain is tied. The fore-legs are now brought together as close as possible, and a long rope is wound round the limbs above the fetters in a figure of 8 and secured between the legs. The elephant is then made to place his hind-legs together, when they are tied in a similar manner to the fore-legs, only much higher up (about half-way up the limb), and a tethering chain applied. The free end is secured round a tree or post.

To fix the head a long rope is taken, one end is tied round the post and the free portion passed under and over the neck and round the post three or more times and carefully tied.

An elephant can shake a man off his back. To diminish the chances of such an accident, take a long rope, pass it round the neck and tie a knot between the shoulders; carry the free end under the tail round to the loop where it should be knotted near where the first knot is tied, by this means it is almost impossible for a man to be shaken off. This leaves only the trunk to be dealt with, and any mischief from this source can be guarded against by the presence of the mahout on the neck, and a man or two below armed with spears.

- (b) Fetter both the fore-limbs, then take the tethering chain attached to fetter, say on left-leg, and pass it over the neck, the animal is now made to assume the crouching posture; the free end of chain is then passed through fetter on right-side, brought back over the neck, and the operation repeated once or twice and the chain secured. It is as well to apply a few gunny-bags over the neck as it is liable to become galled if the animal strains much.

In the jungle and in Siam a 'break' or 'crush' is sometimes used (*see* Figs. 11 and 12). This consists of a number of stout, rough logs set in a V-shaped manner. The elephant is ridden or driven in at A and when he gets near B, posts at D are run through to prevent his getting out, and also at C to prevent his backing. In this cramped position he is unable to apply his strength. It may on very rare occasions be necessary to throw an elephant for the purpose of operation. I only tried it once and this was at Pakökku. The elephant, a fine powerful and most troublesome tusker, was suffering from a severe wound on the spine; also two enormous abscesses on the back; he would not permit any interference. While the mahout was trying to dress the wound the elephant started the bear-like motion and the man fell off and was injured. The cooly could do nothing beyond applying fetters; the animal could not be induced to assume the recumbent posture, so we determined to try and throw him. Two heavy tuskers were brought in case matters became serious. The animal was tethered by one fore-leg to a tree with a good stout chain; fetters were then placed on all four legs, a long chain being fixed on one fore-fetter; this chain was passed through all the fetters, the free end was given to a very fine old elephant 'Rajgopal'; he immediately started to walk away; the men about then took their spears mounted on long bamboo shafts and whenever opportunity offered they touched a fore or hind foot causing him to draw it away. As 'Rajgopal' had a steady strain on the chain, we soon got the legs so far under the beast that he was obliged to sink down amidst much shrieking and trumpeting.

The abscesses were promptly opened and dressed, the wound owing to the presence of maggots was opened up and the maggots removed, after which he was allowed to get up which he only succeeded in doing after several efforts. The shaking he got or the relief afforded by the operation quietened him down; he did not try to injure any one, and next day after a little trouble he allowed the cooly to mount and dress the wounds. This elephant after a course of tonics made an excellent recovery.

Another form of *kya-pazat* is used for the recapture of escaped elephants. Some animals after being free for a time, though permitting men they know to approach them, will not allow them to mount, so the *kya-pazat* is used (see Fig. 1); the head is similar to an ordinary pitch-fork, but barbed like a fish-hook, it is wide enough to stick on to a limb, a light chain or rope is attached to a ring on it. The head can be fixed on a long bamboo. The man sneaks about the jungle after his animal, and when opportunity offers, sticks the pitch-fork on a hind limb; the handle soon comes out, but before long the rope or chain gets entangled in bushes, and the animal cannot get away.

A more barbarous method employed by Karens and Shans is to load a gun with a piece of pointed cane, which is fired into a leg at close range, thus laming the beast.

Most mahouts arm themselves with a light iron hook fixed into a cane or bamboo handle about 2 feet in length (Fig. 7). It should only be employed in emergencies. Some drivers only use a pointed stick.

From time to time endless other coercive appliances have been devised for purposes of restraint (Fig. 8); though patience and gentleness should be exercised in dealing with any animal, it is still more necessary in these creatures, and everything should be tried before forcible measures are resorted to.

The following are the instructions laid down for securing elephants in the Manual of Mountain Artillery, 1882:—

- (i) Anklet on one fore-foot only, the other ankle linked through the ring of a long chain, hook-end secured round a tree, post, or into the ring-bolt. For day use.
- (ii) Long chain round one hind-leg to tree, post, or ring-bolt. For day use.
- (iii) Above, with anklets on both fore-feet.
- (iv) Anklet on one fore-foot only, the other linked on ring-bolt.
- (v) Both anklets on fore-feet, coupling chain through ring bolt.
- (vi) Above, with long chain on one hind-leg (only allowed in special cases).

Instructions for securing elephants for transport by train or sea are given in the Government Regulations on the subject.

Destruction.

It occasionally happens that owing to severe injury or incurable disease an animal has to be destroyed. To those who may be called upon to do this it is necessary to know the shots by which the brain may be readily reached. The brain is not large and is situated low and far back. The places usually selected are the forehead, ear, and behind the ear (*see* diagram No. 26).

- (a) *Front or forehead.*—The point to aim at is the centre of the forehead, near the top of the large bump at the base of the trunk, which if a line is drawn between the eyes would be about 3 inches above them. Both the person shooting and the animal should be on more or less level ground, the animal also facing and carrying the head in the natural position.
- (b) *Ear, temple, or side shot.*—The animal standing on more or less level ground and head held in natural position; the best spot to aim at, if the person shooting be also on level ground, is the ear-hole, in a line to pass through the opposite ear-hole. Other side shots may be taken in the region of the temple, depending on position of person shooting.
- (c) *The rear or behind ear shot.*—Sanderson describes as follows:—"The spot behind the ear is in the hollow just over the large lump or swelling at the junction of the jaw and neck. It must be taken at about an angle of 45 degrees with the elephant's course from behind."

When charging, the head is elevated and the trunk curled up, so it is necessary to fire at least a foot lower than when the head is held in the natural position. If a tusker, fire between the tusks.

The chief thing in shooting an elephant is to approach as close as possible in order to make certain of the shot, as the mark at a little distance is easily missed. Cover should be taken, and the best time to stalk the beast is while he is feeding; great care must be paid to the direction of the wind, which should be from the animal, the wind should be taken every few yards with feathers or wood-ashes.

With regard to the weapon to be used, there are many advocates for small bores, and a rifle such as a '303 with nickel bullet, owing to its great penetration, will kill an elephant as efficiently as a much larger bore; still picked shots are required, and luck also, and we sel-

dom hear of the animals wounded by small bores and not bagged. A small bore is a poor weapon when face to face with an infuriated elephant. To inexperienced persons I recommend the heaviest weapon they can conveniently carry, such as a .450 cordite (nickel bullets) a .577 express, with steel tipped bullets, or, better still, an 8-bore with hardened lead bullets. It is desirable to have a second rifle at hand in case of accidents.

The body shot should be taken rather low, a little above and behind the elbow just near the wrinkle usually observed in that region. This shot should not be taken where people are about, as even with a four-bore bullet placed in this position, an animal may run for 60 or 80 yards.

CHAPTER III.

OUTLINE OF THE ANATOMY OF THE ELEPHANT—ARTICULATIONS—SKULL—TEETH—THE SPINE—CERVICAL VERTEBRÆ—DORSAL VERTEBRÆ—LUMBAR VERTEBRÆ—SACRAL VERTEBRÆ—CAUDAL VERTEBRÆ—STERNUM—RIBS—EXTREMITIES—PELVIS—FOOT—THE ALIMENTARY CANAL—MUCOUS MEMBRANE—STOMACH—SMALL INTESTINES—LIVER—SPLEEN—URINARY ORGANS—ORGANS OF GENERATION—IMPREGNATION—ACCESSORY ORGAN OF REPRODUCTION—THE THORAX OR CHEST—HEART—RESPIRATORY ORGANS—NOSE—EYE—LACHRYMAL APPARATUS—EAR—MUSCULAR SYSTEM—SKIN—WEIGHT OF CARCASS.

Outline of the anatomy of the elephant.

EXTERNAL form is dependent upon an internal basement structure. This consists of a number of definitely but diversely shaped masses of a hard substance called bone. This basement structure is known as the skeleton. The bones entering into its formation are of various forms and sizes depending on the uses for which they are intended. They are divided into three classes: long, flat, and irregular. The first named are situated in the limbs; they have a shaft, and two extremities. *Examples*:—arm bone (humerus), thigh bone (femur). The scapula or shoulder blade, pelvis, and frontal bones of the head are examples of flat bones. The bones of the knees and vertebral column are examples of the irregular type of bones. Bone of which the skeleton is composed, is a tough, hard, elastic substance, consisting of animal matter impregnated with earthy salts. The earthy salts may be removed from the bone by immersion in dilute hydrochloric acid; the figure of the bone remains unchanged, but instead of being hard, it will be found to resemble cartilage or grizzle, and may be twisted in any direction. The composition of bone is as follows:—

Earthy matter	...	...	...	...	66·7
Animal matter	...	...	...	...	33·3
					—
				Total	...
					100·0 Ashby.

The ends of the bones are constructed in different ways to permit of more or less motion. In some parts there is a ball and socket arrangement, in others hinge-like joints, and so on.

The skeleton gives support to the animal frame, and affords fixed objects for the attachment of various parts. In order to admit of

motion, the bones are connected one to another by means of strong bands, known as ligaments.

Locomotion is effected by means of muscles, which have usually two separate attachments to bones, so that when they contract, they become shorter and broader, and the points of attachment are thus brought nearer.

Articulations.

The various bones that form the skeleton are connected together in different ways: such connections are known as joints or articulations.

In the skull we find the bones united by a dovetailed arrangement (sutures), the edges of the bones are serrated, the projections of one bone fitting into depressions of the other, which are held together by the periosteum (the membrane covering bone). In joints such as these no motion is required.

The connection between bones in the spinal column is an example of another form of joint. Here only a very limited amount of motion is required, and we find that the contiguous surfaces of the bones are connected by interposed cartilaginous tissue running from one bone to the other.

And lastly we have moveable joints. In these joints we have the surfaces of the extremities covered with a thin layer of cartilage, or grizzle (a firm elastic substance, of a bluish colour; it helps to lessen friction, gives freedom to movement, and to diminish shock), which is surrounded by a capsular ligament, which is attached to the edges of the articular surfaces. This ligament is lined by a membrane, which secretes synovia, a lubricating fluid commonly called joint oil. The amount of motion permitted varies least in the knees, and greatest in the ball and socket joints, as shoulder, hip.

Skull (see Figs. 21 and 22).

The construction of the skull differs widely from that of most animals. The cranial much exceeds the facial portion in size, its upper part forming an expanded dome, the remainder being formed of bony cell structure (air sinuses), which separate the outer from the inner table of the skull; the structure is so disposed as to afford great strength with little material. During early life these cavities are small, but with age they increase greatly.

The nasal bones are short, triangular, and pneumatic, forming the lump or boss, seen immediately above the root of the trunk. The cavities or sinuses are broken up into numerous subdivisions by irregular partitions, and are lined with a delicate membrane; they communicate freely with one another and with the nasal cavities, and while their aggregate bulk constitutes a very considerable portion of the skull, so very thin and light are they, that if a section be made of that portion of the head which includes the greater portion of them, it will be found to weigh from eight to eleven pounds, whereas that of the entire skull often exceeds 100 lbs. in weight. The average weight of five skulls of male elephants was found to be $114\frac{2}{5}$ lbs.; one of these, however, was an exceptionally large head, weighing $175\frac{1}{2}$ lbs., *i.e.*, upper jaw 59 lbs., lower jaw $116\frac{1}{2}$ lbs. Owing to the peculiar structure of the skull referred to, a large extent of bony surface is provided for the attachment of muscles, without materially adding to the weight of the head, and by means of the air contained in the sinuses, the skull is rendered buoyant, the animal being thus enabled to support the enormous weight of the teeth and lower jaw. The large amount of cell structure interposed between the outer and inner tables of the skull affords such an important organ as the brain great protection.

The bony nostrils are formed by the nasal and premaxillary bones; the nasal chambers are very short and vertical. The turbinal bones situated within the nasal aperture are rudimentary, and it is here that we find the apertures admitting air into the extensive air chambers of the skull.

The lachrymal bone is small, protuberant, and imperforate.

The cavity in which the brain is lodged is situated low and far back. The brain is oval in shape (*see* Fig. 23), and the division between the large and small brain is vertical, *i.e.*, they lie on a level plane without overlapping. 'The olfactory lobes from which the nerves of smell proceed are large, whilst the nerve of sight and muscular nerves of the muscles of the eye are singularly small for so vast an animal; and one is immediately struck by the prodigious size of the nerve which supplies the proboscis with its exquisite sensibility, as well as by the great size of the motor portion of the nerve which supplies the same organ with its power of movement and action.'—(*Emerson Tennent.*) In animals of ordinary size, the brain weighs from 15 to 17 pounds.

The lower jaw is short, the ascending portion being almost as large as the horizontal branch; the junction between the two is short and pointed. The dental canal is wide and excavated to accommodate the enormous grinders, and to afford space for the formation and growth of the succeeding teeth.

Teeth.

The teeth are large, complex, and special in their mode of replacement. Steel in his "Indian Veterinary Manual" gives an excellent description of the process, which I take the liberty of quoting: "Generally on each side of each jaw, two or three teeth may be seen; the front one is small, often loose, and is sometimes shed, because the growth of the second gradually cuts off the supply of nutriment by compression of the fangs. The second or main tooth consists of a number of subdivisions composed of dentine coated by enamel, arranged in a linear series from before backwards. All these are buried in an enormous bed of cementum, layers of which are between each subdivision and coating every part of the surface, except the depressions for the pulp cavities and the table or grinding surface of the tooth." In the Indian elephant the enamel on the tables is arranged in transverse ridges. Only two teeth, as a rule, can be seen on each side of the jaw; these are pushed out and replaced by others growing from behind. Many male elephants possess tusks; these are placed in the premaxillary bone, they grow from a persistent pulp.

The statement of Corse in Brewster's Edinburgh Encyclopædia with reference to the growth of the teeth, and quoted by Steel (Indian Veterinary Manual, page xxviii) is most interesting. "The first set of grinders or milk-teeth are not shed, but are gradually worn away during the time the second set are coming forward, and as soon as the body of the grinder is nearly worn away, the fangs begin to be absorbed. From the end of the second to the beginning of the sixth year the third set come gradually forward as the jaw lengthens, not only to fill up this additional space, but also to supply the place of the second set, which are, during the same period, gradually worn away and have their fangs absorbed. From the beginning of the sixth to the end of the ninth year the fourth set of grinders come forward to supply the gradual waste of the third set. In this manner to the end of life the elephant obtains a set of new teeth as the old ones become unfit for the mastication of his food. The milk-grinders consist each of four teeth or laminæ, the second set of grinders of eight or nine laminæ, the third set of twelve or thirteen, the fourth set of fifteen, and so on to the seventh or eighth set, when each grinder consists of twenty-two or twenty-three; and, it may be added that each succeeding grinder takes at least a year more than its predecessor to be completed."

The term "tush" is applied to the small tusks of females and some males, though the latter ordinarily carry the large teeth known

familiarly as "tusks." Tusks and tushes are simple teeth found in the upper jaw embedded in deep bony sockets, the pulp cavity (in young elephants) extending into them for a considerable distance, but in aged animals the cavities are much diminished in size. On removing a tusk the pulp which resembles a large conical-shaped sausage, may be taken from the cavity without trouble. The Burmans prize the pulp, as it is considered a specific for some disease. With regard to the *tushes* Steel states: "The *tushes* afford indications of age appreciable to natives. Sanderson erroneously affirms "they are never renewed or shed. They vary much in different varieties, and no doubt his remark applies to some; however, in others "the milk tusks are shed between one and two years of age and replaced by the permanent ones which often attain 70 lbs. weight "in the male." Sanderson, page 67, says: "The tusks of the male "elephant-calf show almost from birth. I believe that they are never "renewed, and that the first tusks are permanent. In many works on "the elephant it is stated that the first tusks are shed before the "second year, but I believe this to be an error, one that has gained "ground through so many writers deriving their information from a "common source. I have made this a point of particular enquiry "amongst experienced elephant-attendants, and have found them "unanimous in dissenting from the idea of any such process of "renewal." He also remarks: "I have had many young elephants in "my charge and never noticed anything of the change alluded to." I have asked many foresters, Burmese and Karen, about this matter; they are of opinion that the tusks are never shed; I have, however, also been informed of one or two instances of milk tusks being shed and renewed.

A small percentage of males have simple *tushes*, which are similar to those of the female, except that they are a little longer and thicker, and some have none at all; the first are known as *han* (ဝဲ\$) and the latter as *haings* (ဝဲ\$). Some few males have a single tusk only. The Burmans consider it lucky to own an animal possessing a right tusk only; such an animal is known as a *te* (ဝဲဝဲ) (*see Plate C*). Males occasionally lose a tusk when fighting, or through other injury, but some are born with a single tusk. The late Mr. Darwood, who owned many elephants, records a case where one of his elephants dropped a male calf which grew up with only one tusk.

Burmans, Karens, and others when judging the age, carefully examine the tusks with regard to their soundness, size, colour, sweep, spread, and amount of wear shown.

Tusks are formidable weapons of offence; they can be brought into use at almost any angle. Tuskers in a herd maintain discipline, and are justly feared by the members of it. At times most

ghastly wounds are inflicted with these weapons, and when tuskers fight, one or other of the combatants is frequently killed, or dies of wounds inflicted. Well trained tuskers are highly valued, as owing to the possession of these organs, they are enabled to perform a variety of work which cannot be undertaken by animals without them. Strange as it may appear, there are occasional instances where a *haing* is feared even by powerful tuskers. Mr. C. B. Lacey informed me of one or two cases within his knowledge. Mr. Danson also informed me of a case, and I myself have met with one instance. It is also a generally recognized fact amongst the Burmans. In such cases it will usually be found that the *haing* is an enormously powerful elephant with an unusually fine development of the trunk; the strength and dexterity in its use when fighting against a tusker is said to fully compensate for the absence of tusks. In Pegu some years ago, a reliable Burman tracker casually informed me about a fight he witnessed in the jungle between a very large *haing* and an ordinary sized tusker; though the *haing* received some nasty wounds, he put the tusker to flight.

Tusks are occasionally snapped during fights. Mr. Danson, of Messrs. Darwood and Company, showed me a piece of a very fine tusk fractured about a foot or so from the point. This piece, when found in one of the Shweli forests, was covered with congealed blood.

The Spine.

The spine or backbone is composed of a number of bones termed vertebræ. In animals the head is suspended from it. It also forms a tube for the accommodation and protection of the spinal cord, a part as important as the brain itself, being the bond of union between all parts of the body. The backbone is possessed of great strength and flexibility. For convenience of description, it has been divided into five parts; namely, cervical, dorsal, lumbar, sacral, and caudal. In the Indian elephant there are seven cervical, twenty dorsal, three lumbar, three or four sacral, and thirty-one caudal vertebræ. Owen gives the following:—cervical 7; dorsal 20; lumbar 3; sacral 3; caudal 31. There are undoubtedly variations and peculiarities in individual skeletons. In some specimens there are only nineteen dorsal vertebræ bearing moveable articulated ribs.

Cervical Vertebræ.

Seven in number. The first from its supporting the head is known as the atlas; it is very similar in appearance to that bone in the

human subject, and is in form something after the shape of a signet ring. The second or axis, may be readily recognized, as it possesses a conical tooth-like process, and has a massive spine which is bifid posteriorly. The bodies of the fourth, fifth, and sixth are short, the spinous processes are also short. The seventh may be distinguished by its long spine, and also by its having on its posterior edge a cavity for the articulation of the first rib. Owing to the immense weight of the head, we find that the neck is extremely short. The latitude of motion possessed by each bone on those to which it is attached is not as great in elephants as in most other animals; accordingly we find the general flexibility of the neck is comparatively limited, and that when an animal is desirous of observing an object posterior to the direct line of vision, it is necessary for him to turn his body more or less in that direction.

Dorsal Vertebrae.

Nineteen to twenty in number. They are intermediate in size between the cervical and lumbar, and are to be distinguished by their long superior spinous processes, which proceed upwards and incline backwards; they form the "withers" and greater portion of the spinal ridge.

Lumbar Vertebrae.

The lumbar vertebrae are three in number; they may be distinguished by their longish, flattened, transverse processes, which give support to the muscles of the loins.

Sacral Vertebrae.

The sacrum is short and arched, and formed by the union of three or four bones, which in the young animal are separate. It is more or less triangular in shape, with its base anteriorly and apex posteriorly placed. In very old animals the last lumbar vertebra may become united to the sacrum. The sacrum forms a roof to the pelvis, and affords protection to its contents.

Caudal Vertebrae.

Thirty-one in number, but in many specimens it will be found that from accident, &c., there are less. The anterior ones show in

a rudimentary form the essential parts of a vertebra, but posteriorly they become cylindrical rods, convex on their anterior and posterior surfaces.

The head and first bone of the neck have free motion up and down. The joint formed by the next bone of the neck also has free motion, chiefly to either side. The bones of the back have the least motion, they confer strength, and permit of motion of the ribs. The bones of the loins possess slightly more motion. If the vertebræ be examined, certain holes will be observed on either side; these are for the passage of spinal nerves, &c.

Sternum.

The sternum or breast bone is situated in the middle line, on the inferior aspect of the chest. In young animals it is cartilaginous, and consists of several segments, which later on become consolidated. The lateral surfaces present indentations for the reception of the cartilages of the sternal or true ribs. The sternum also helps to protect the heart and lungs from injury.

Ribs.

The ribs constitute a series of long arched bones which are connected to the lateral sides of the spinal column above, and mostly to the sternum below. There are from nineteen to twenty pairs, increasing in length from the first to the tenth, after which they decrease. They are divided into (*a*) true or sternal ribs, namely, those that join the sternum directly; (*b*) false or asternal, those that do not; and (*c*) floating ribs, those that have no attachment below. The first two or three sternal ribs are very stout and short, and only slightly curved, as the chest in this region is very narrow. The articulation between the heads of the ribs and the vertebræ in the region of the chest is a synovial one, permitting of a certain degree of motion. The ribs form the walls of the chest, and protect the important organs within and their articulations with the vertebræ above and the breast bone below, admitting of slight motion, they assist in respiration.

Extremities.

In the skeletons of most mammalia it will be observed that the bones of the limbs are set at certain angles, in order to diminish

shock, especially during such acts as leaping and galloping, whereas in the elephant the bones are not set at angles, but almost in a vertical line; the reason for this is apparent when we consider the immense size of the body to be supported. It is this particular formation that renders these animals incapable of making the slightest spring. Sanderson states that "a trench seven feet wide is impassable to an elephant, though the step of a large one in full stride is about six and a half feet." From the position of the bones it is evident that the elephant is intended to sustain weight, *i.e.*, is a beast of burden; and this fact to some extent accounts for the discomfort experienced when riding these creatures.

The fore extremities.—The clavicle or collar-bone is rudimentary.

The scapula or shoulder-blade is of great size; it is unequally divided by a ridge or spine, and from about its centre is a process directed backwards. The cavity with which it articulates with the next bone is very shallow, and looks downwards.

The humerus is also large, and affords extensive surfaces for the attachment of muscles.

The fore-arm consists of two bones, the ulna and radius, which in the elephant are distinct and peculiar in that they are obliquely and permanently crossed. "The upper end of the latter (radius) is small, while the ulna not only contributes the principal part of the articular surface for the humerus, but has its distal end actually larger than that of the radius, a condition unique among mammals."—(*Flower*).

The knee in the fore, and the hock joint in the hind limb are situated very low down, namely, just above the pad or hoof.

The knee-joint or carpus is made up of a group of eight distinct small, but very hard, irregular-shaped bones.

"There are five digits with short, stout phalanges, the terminal ones being very small, and of irregular form."—(*Flower*.)

The hind extremities.—As in the case with the fore limbs, the vertical disposition of the bones is observed, and to some extent bears a strong resemblance to the arrangement of the bones in the human subject.

Pelvis.

Pelvis or haunch bone, so called from being likened to a basin, is the medium by which the hind limbs are connected to the body. It is of peculiar conformation, not unlike the human pelvis, and is set almost vertically to the spinal column. The acetabula are the cavities provided for the reception of the heads of the thigh bones, or femora. Owen states that "the planes of the acetabula incline

“from the perpendicular about 70 degrees, a favourable position for transmitting weight upon the heads of the femora.” There is no question that this construction is adapted for bearing downward pressure; it is a conformation in which immense strength is secured at the expense of suppleness, and is another reason why the gait of the elephant is such a source of discomfort to the rider.

The femur or thigh bone is a long bone, more or less cylindrical in form, at its upper extremity is a rounded head which fits into the socket or acetabulum, and forms the hip joint. The lower extremity articulates with the tibia (the stifle joint of the horse).

“The patella, or knee-cap, is slightly convex-lengthwise, and concave transversely at its articular surface.”—(*Owen.*)

The tibia and fibula comprise the second segment of the limb. The first-mentioned is by far the larger bone; its upper end is expanded, the shaft of the bone is somewhat triangular in shape. The lower extremity is also expanded slightly to receive the bones of the hock.

The fibula is distinct from end to end; at its upper extremity it is connected to the tibia, just below the joint, and its lower end enters into the formation of the hock joint.

As with the fore-foot, three groups of bones go to form the skeleton of the hind foot, namely:—

- (a) The tarsus or hock, consisting of seven bones.
- (b) The metatarsals.
- (c) The phalanges or toes.

Foot.

By the term foot is meant the “hoof slipper” and the parts contained within it. In the elephant the “hoof slipper” consists of the sole and toe nails.

The shape of the sole in the fore-feet is nearly round, while that of the hind-feet is more or less oval. It consists of a layer of soft, elastic horn, and though thick and tough, it may be made to bend under pressure of the fingers. Anteriorly it bears the nails; posteriorly the margins curl upwards. On removal of the slipper, and inspection of its inner surface, it will be seen to be covered with numerous indentations; these small holes lodge projections from the sensitive sole.

The toe-nails vary in number from sixteen to twenty, but the more usual number is eighteen, namely, five on each fore, and four on each, hind foot. It has been already noted that the knee and hock joints are situated very low down, the digits running obliquely down-

wards. The terminal [bone of each digit lies within one of the nails. If the internal surface of a nail be examined it will be found to be traversed in a vertical direction by a series of horny leaves or laminæ; it will also be observed that the extremity of the digit as exposed by removal of the nail, is also traversed by a series of laminæ known as the sensitive laminæ; they fit in between the horny laminæ of the nail. It is by means of the indentations on the interior of the sole, and the laminæ above noted, that union is brought about between the horny and underlying sensitive structures.

The hoof slippers are not rigid boxes like the hoof of the horse; each digit is provided with tendons for flexing or extending it, thus permitting of a great degree of motion. The noiseless tread of the elephant is a subject of common remark. The reason for it is that a large quantity of a fibro-fatty substance enters into the formation of the foot, which goes to make a wonderful elastic cushion. The elephant is by nature intended to roam about the vast forests, where the soil is usually soft, or the ground is covered to a depth of many inches by fallen leaves. Under natural conditions the "hoof slipper" affords ample protection to the underlying sensitive structures.

The Alimentary Canal.

Mouth.—The cavity of the mouth is remarkably small, "a fact which is demonstrated by the precision with which the food is passed into it by the proboscis, and the small part which the lips consequently play in the act of prehension."—(*Miall and Greenwood*). The roof of the mouth is quite smooth, the sides are formed by the cheeks, which are sufficiently loose to permit of limited motion of the jaws, the powerful muscles of which act chiefly in their grinding motion.

Lips.—The upper lip is blended with the nostrils to form the trunk; the lower lip is small and pointed.

Teeth.—A description has already been given, see page 57.

Tongue.—The cavity of the mouth is occupied chiefly by a muscular organ, the tongue, which is very small. The tip lies in the groove formed by the lower lip, and the organ is possessed of more freedom anteriorly than posteriorly. It is the organ of taste.

Pharynx.—The pharynx is a cavity situated behind the tongue, and through it the food is conveyed to the gullet, or œsophagus.

Æsophagus.—The œsophagus or gullet is a muscular tube, extending from the pharynx to the stomach; the calibre of the tube is small. On the authority of Dr. Harrison, Tennent gives an illustration of a muscle passing from posterior part of the windpipe to the gullet which he thought "might raise the cardiac orifice of the stomach,

“and so aid this organ to regurgitate a portion of its contents into the “œsophagus.” (See Fig. 25.) I have never observed this muscle.

The *abdominal cavity* or belly is of large size, the nature of the food requiring a great volume in the intestines. The cavity is bounded in front by the diaphragm or midriff, which separates it from the chest cavity, posteriorly by the pelvis, above by the backbone, laterally by the ribs and their muscles, and below by the abdominal muscles. The cavity contains a portion of the gullet, the stomach, intestines, liver, spleen, pancreas, kidneys, and the uro-genital organs. On opening the cavity shortly after death it will be observed that the intestines are alternately contracting and relaxing, but always working down the gut, so as to force onward the contents. The movement like that of the heart is automatic.

It will be noted that the cavity is lined by a glistening membrane which is also reflected over the organs. This membrane is known as the peritoneum. Its function is to secrete a small quantity of fluid to prevent friction, and so permit the continual motion of the bowels to go on without injury.

A striking point is the slight amount or entire absence of fat in these creatures.

Mucous Membrane.

Is a delicate membrane lining those inner parts of the body which are, in direct communication with the external air, namely,—

- (a) from the nostrils to the minute ramifications of the lungs ;
- (b) the whole alimentary tract from the mouth to the anus ;
- (c) from the penis or vagina to the bladder.

It is furnished with blood vessels, nerves, &c. In health it is of a delicate pink colour, in fever and inflammations it becomes reddish and the minute blood-vessels are frequently injected, when the liver is deranged they assume a yellowish tint ; and in debility and anæmia the membrane is usually pale and bloodless. In the elephant the colour of the mucous membrane covering the mouth, tongue, and palate is easy to note, sometimes that covering the eye can also be seen, and this being of a highly delicate structure shows any changes in a marked manner.

Stomach.

The stomach (see Fig. 24) is a single sac unlike that of most herbivora, smooth externally, and measures from $2\frac{1}{2}$ to 3 feet long ; that of

the last elephant I examined (a large tusker) measured 3 feet 4 inches. It has two extremities, the cardiac and pyloric, and two openings, one communicating with the gullet known as the cardiac, and the other with the intestines, the pyloric. The stomach is situated towards the left side, and the spleen is attached to it. The cardiac end is long and tapering, the interior is lined by mucous membrane. "A number of transverse nearly circular folds project inward from the cardiac wall; they almost disappear when the stomach is greatly distended, and are at all times too shallow to serve as water cells, though they have been figured and described as such."—(*Miall and Greenwood*). I have examined several stomachs and agree with the above remark, also *see* remarks on trunk, page 71. The gullet enters the stomach almost at the centre.

Small Intestines.

The small intestine begins at the pyloric orifice of the stomach and ends on entering the cæcum, a dilated pouch some distance down. For convenience the intestine has been divided into three parts, namely, the duodenum, jejunum, and ileum. The intestine may be recognized by its smaller calibre and smooth regular contour when distended. The secretions poured into the small gut are bile from the liver, pancreatic juice from the pancreas, and secretions from glands in its own walls.

The respective total lengths of the small intestine of four elephants were 66, 70, 73, and 74 feet.

The large intestine is capacious and may be distinguished by its puckered appearance, due to the presence of longitudinal bands, which are shorter than the intestine. It is also divided into three portions, namely, the cæcum, colon (which is the largest portion), and the rectum, which terminates at the anus, the orifice of which is guarded by a special muscle.

The intestines are attached to the spine by a strong membrane called the mesentery, which also serves to sustain the bowels, and affords passage for important vessels.

The total lengths of the large intestine of four elephants were respectively 38, 40, 46, and 43 feet. Steel records the length of bowels in an elephant nine and half feet at the shoulder as follows: small intestines 76 feet, cæcum 5, colon 20 feet, and rectum 12 feet. Total large intestine 37 feet, and of intestinal tract, 113 feet.

"Hunter gives 17 feet as the length of the small intestine; Mayer makes it 37 feet, while he gives the total length as 75 feet."—(*Miall and Greenwood*.)

LIVER—THE SPLEEN—THE URINARY ORGAN.

Owen's measurements taken from a young Indian elephant seven feet at the shoulder, are as follows:—

			Feet	ins.
Length of small intestine	...	...	38	0
Length of cæcum	...	...	1	6
Total length of colon and rectum together	...	...	20	0
Total length of intestinal canal, exclusive of cæcum	...	...	58	6

Liver.

This is the largest gland in the body; there are two lobes, the right being the larger. The gall-bladder is absent. The duct which carries the bile expands, and forms a pouch in the wall of the duodenum; the secretion from the pancreas is also received into this pouch. The weight of the liver varies between 50 and 55 lbs. Hawkes, in the case of a male elephant aged 34 years that died of heart-disease, found the liver to weigh 65 lbs., and in a very small elephant aged 24 years, it weighed $58\frac{1}{2}$ lbs. Gilchrist gives the weight of this organ in an animal he examined as $76\frac{1}{2}$ lbs.

The Spleen.

Average weight of four spleens was 7 lbs. This organ is generally enormously enlarged in animals that die from anthrax fever.

The Urinary Organ.

Kidneys.—These are situated one on each side of the spine, beneath the lumbar vertebræ. The weight of the kidneys, 6 to 8 lbs. Gilchrist gives it as 16 lbs. In structure they resemble the kidneys of the ox, in that they are lobulated; the lobes are distinct, and vary in number from five to six.

The *ureters* are two tubes which convey the urine from each kidney to the bladder. The orifices of the ureters on the inside of the bladder are in adults from two to three inches apart.

The *bladder* presents no remarkable features; it serves as a reservoir for the urine, and thus prevents the extreme inconvenience that would result from having to discharge the urine as fast as it is secreted. On the accumulation of a certain quantity, which amount varies in different individuals, a very uneasy feeling due to nervous influence is experienced, which induces the animal to discharge it. The neck of the bladder is supplied with a large amount

of circular muscular fibres, their office being to keep the orifice of the bladder closed.

The urine is discharged from the body by means of the urethra, a membranous canal extending in the male from the neck of the bladder to the extremity of the penis. In the female it is very short, and opens into the uro-genital canal.

The Organs of Generation.

In the male we find glands to secrete the seminal fluid (testicles), and an instrument, the penis, by means of which this fluid may be conveyed to the necessary receptacle in the female.

The testicles are two glandular bodies, globular in shape, the substance is soft, and on section, of a light brownish colour. They are suspended freely in the abdomen, and are situated below the posterior extremities of the kidneys.

The penis is a long fleshy body, which serves to afford passage to the urine, and also to eject the semen. At its extremity is the opening of the urethra, which in this animal is Y-shaped.

With a view to preventing that peculiar sexual disturbance known as "muth" many attempts have been made to castrate these creatures; but owing to the immense size of the carcass, and the peculiar position of the testicles, the operation is necessarily a very formidable and dangerous one. The operation must be performed on both sides.

The female organs of generation are divided into external and internal.

The external or uro-genital opening known as the vulva is not situated near the anus, as in many animals, but is drawn forward, and so occupies the position of the penis in the male. The sides are loose, and the labiæ or lips, covered with mucous membrane, form a prepuce or covering for the clitoris.

On separating the lips of the vulva, a fleshy body varying in length from 12 to 16 inches, known as the clitoris, is observed. It is the analogue of the penis in the male.

The internal organs are the vagina, uterus, fallopian tubes and ovaries.

The vagina is a canal lined by mucous membrane. "It is about 12 to 15 inches long."

At the end of the vagina is the entrance to the uterus or womb, which organ is peculiar in that the greater part of it is divided into two horns. Outwardly, the uterus is with difficulty distinguished from the vagina.

The fallopian tubes are two tubes leading from the horns of the uterus to the ovaries.

The ovaries, or female testicles, are small bodies surrounded by a firm, fibrous capsule. The substance consists of a network of tissue, blood vessels, &c., in which are embedded the ova, which are destined on being fertilised to develop into the offspring.

Impregnation.

The ovum on being discharged from the ovary is caught by the abdominal extremity of the fallopian tube, from which it is passed on down to the uterus, where, if it is unimpregnated it dies and is discharged; but if impregnated by the spermatozoa contained in the seminal fluid, undergoes certain changes which ultimately result in the reproduction of the species.

Accessory Organ of Reproduction.

The udder consists of two glands, and as already mentioned, is situated on the breast, just behind the fore-legs. In the virgin state it is small, but during the latter period of gestation, it becomes considerably enlarged, and some little time before parturition, milk is secreted. The glands consist of lobes, bound together by connective tissue and fat. The milk as secreted, is carried by sets of channels, which converge at a point where they form dilatations, which act as reservoirs. The ducts again become contracted, and open finally on the summit of the nipples, or teats, of which there are two.

The Thorax or Chest.

Is a large chamber bounded laterally by the ribs and their muscles, above by the spine, below by the breastbone, and behind by an obliquely placed musculo-tendinous partition which separates it from the abdominal cavity, and is known as the diaphragm or midriff. It contains the heart and respiratory organs and is deep and narrow. It is peculiar in that there is no cavity intervening between its walls and the lung owing to these organs being adherent to them; in other words there is no pleura. This is a condition entirely different from what occurs in most mammals in which the lungs, though lying in contact with, have no actual attachment to, the walls. In this respect the elephant resembles birds. This peculiarity is adapted to

his mode of life, which seldom subjects him to respiratory emergencies, and his organization which does not necessitate much blood oxygenation.

Heart.

As in other mammals the heart is a four-chambered muscular organ which is contained in a fibrous bag called the pericardium and is placed between the lungs. It is peculiar in that its apex presents two points instead of one like most mammals. This peculiarity is, however, shared by certain whales, dugong, &c.

Another peculiarity observable is, the absence of fat about the organ.

Weight-average of three hearts, 24 lbs.

Respiratory organs:—

- (a) *Larynx*.—This consists of a chamber opening below the base of the tongue by which air is conducted down the trachea or wind-pipe into the lungs. It contains the *essentials* in the production of voice.
- (b) *Trachea and bronchi*.—The trachea or wind-pipe is a tube composed of a series of cartilaginous rings, which rings are incomplete behind. It divides into two tubes of smaller calibre called the bronchi, which enter the lungs and ramify throughout their substances. These air passages are unusually long and narrow.
- (c) *Lungs*.—Are two spongy organs, one on each side of the chest, to the walls of which, as already remarked, and to the diaphragm, they are intimately attached. The left can be readily distinguished from the right by presenting no deep fissures in its contour.

Weight.—The average weight of the lungs of four animals was 46 lbs.

Nose.

The nasal apparatus consists of certain structures which serve to form two passages whose function is to conduct air from without, into the air chambers in the bones of the skull, and also to the back of the mouth and so through the windpipe to the lungs. These passages are lined throughout with mucous membrane, in the uppermost part of which are lodged the nerves concerned in the sense of smell. It may conveniently be divided into two parts, namely, the muscular portion, or trunk, and the osseous, or bony.

(a) *The muscular portion or trunk*—is a most remarkable appendage, but is not peculiar to the elephant as the tapir has a somewhat similar organ. It is composed of an intricate arrangement of muscles which furnish it with great flexibility, contractility, and power; so that its uses are manifold. The animal is enabled to snap off boughs, pull down saplings, pluck up bunches of grass and herbs—in fact on his trunk depends his life, since both food and drink are ingested through its aid. He can employ it to lift and drag light weights. An elephant will not use his trunk either for offence, defence, or work, where there is any probability of this extremely sensitive and essential organ sustaining any injury, and this is exemplified by the way in which he curls up the organ after the manner of a watch-spring, and raises his head when in the act of charging, and not free and uplifted as often represented in many pictures.

At the extremity of the trunk the anterior part is developed into a finger-like structure, which is capable of being approximated to the posterior wall. By means of this process he is able to pick up articles of small size, but not to the extent that he has been popularly credited with. Its contractility is shown by his power of shortening and lengthening this organ, and as will be again referred to on some future page, this contractility by causing a shrivelling of the trunk often serves as a valuable indication of ill-health. Again, it is through the muscular character of its walls that he is able to dilate the canals, and increase their capacity during the act of suction. This muscular mechanism is supplied by the seventh pair of nerves which are unusually developed in this animal and hence accounts for its power, varied, and complicated mobility. The skin covering the trunk is soft and pliable, and that in the posterior region is puckered into a series of transverse ridges giving it a permanent roughness which materially aids in the tenacity of its grip. It is also the medium through which this organ is endowed with one of its most important uses, for it is in the deeper layers of the skin that the elements of the sense of touch are lodged. It is supplied by the fifth pair of nerves which are also unusually developed in the elephant and accounts for its exquisite sensibility.

The canals are two in number and lie nearer to the front of the organ. They are of about the same calibre throughout, and are lined by mucous membrane. They are capable of a certain amount of distension and, in addition to serving as conductors of air to the lungs and air cells, are converted into temporary reservoirs in the act of drinking. The end of the trunk during this act is placed in the water and by suction (an inspiratory effort) a quantity is drawn up into the canals. The trunk, when a sufficiency has been taken up, is withdrawn, and inserted far back into the mouth, where by an ex-

piratory effort the contents are expelled and swallowed, or in the act of bathing ejected over its body. It is highly improbable that the mucous membrane lining these canals is in any way concerned with the sense of smell.

Every one familiar with elephants must have observed the peculiar habit they have when heated of inserting the trunk into the mouth and by suction withdrawing fluid which they squirt over the body. Many theories have been advanced as to where this fluid is accumulated; some investigators say that the stomach is the reservoir and that the cell-like formation at one end (much exaggerated in the drawing) can hold as much as ten gallons of water, and Dr. Harrison found a muscle connecting the back of the windpipe with the forepart of the gullet, one of the functions of which he thought might be to raise the cardiac orifice of the stomach and so enable it to regurgitate its contents into the gullet. (The muscle alluded to must have been abnormal as, I believe, other anatomists have not found it. I have tried to on several occasions but failed.) Others are of opinion that a special pouch at the back of the throat (pharyngeal) is the reservoir. The point at present is not satisfactorily settled, but as Steel states, the "pouch" is capable of holding a fair amount of fluid which may be supplemented by gradual regurgitation from the stomach. The subject is a most interesting one, and those desirous of obtaining full information should refer to the excellent works of Steel, Sterndale, and Sanderson.

Sounds.—A forcible blast of air blown through the trunk produces the sound familiarly known as "trumpeting," and another peculiar sound is also emitted through the agency of this organ. This is referred to by Sanderson and accurately likened by him to the sounds produced by rapidly doubling a large sheet of tin. This authority says that "it is produced by rapping the end of the trunk smartly on "the ground, a current of air, hitherto retained, being sharply emitted "through the trunk, as from a valve, at the moment of impact." The sound is familiar to those who have indulged in elephant shooting, and appears to be a note of warning on the apprehension of danger.

Vascularity.—This organ is very richly supplied with blood-vessels, and thus accounts for injuries being attended with copious hæmorrhage, which, in fact, may prove fatal.

(b) The *osseous*, or bony portion, is so constructed as to form two irregularly shaped chambers communicating in front with the canals of the trunk, and behind with the mouth. In addition there is free communication with the honeycomb-like pneumatic chambers (or air sinuses) of the head already referred to. The chambers are lined with mucous membrane in which are embedded the ter-

minations of the olfactory nerves or nerves of smell, which, being unusually well developed in the elephant, accounts for the acuteness of this sense.

Eye.

The optic nerve is responsible for the sense of vision, and is unusually small in the elephant, the reason for which is evident when one considers the small size of this organ and the muscles required to move it. Vision is acute, but the animal is greatly handicapped in making a use of this sense to a degree equal to most animals by virtue of the shortness of its neck, which will not permit of the head being rotated sideways sufficiently to see objects in its rear: therefore the only way this can be effected is by a movement of the body, and this is exemplified by watching an elephant walking when he is suspicious of something in his rear. It will be seen to alternately move its body from side to side in order to see what is occurring behind instead of walking straight forwards. However, the limited field of vision is fully compensated for by the extreme acuteness of smell, and perhaps partially by its keen hearing. As is the case with many animals, in addition to an upper and lower eyelid, there is a membranous fold placed at the inner corner of the eye and beneath the lids which is capable of being moved outwards over a considerable portion of the eyeball; this is called the nictitating membrane, the "*haw*" (of horses), and by some authors the "third eyelid." This outward movement is effected by a retraction of the eyeball, which displaces some fat behind the orbit and so mechanically thrusts the lid forwards.

Lachrymal Apparatus.

There is no true lachrymal (tear) gland, but this is replaced by a gland situated on the inner side of the orbit called the Harderian gland which pours its secretion on to the third eyelid, whence the tears so produced fall on to the face. There being no apparatus to convey them into the nose, such as exists in most animals.

Ear.

There is nothing of special interest to note, except as previously mentioned as an indication of age (*see page 5*).

Muscular System.

This system is remarkable in that a large amount of tendinous fibre runs through the muscles, making them very tough. About the shoulders and buttocks the muscles are fleshy, but even here there is a considerable admixture of tendinous fibre.

Skin.

In the wild state it is somewhat difficult to estimate the true colour, as when met with, they are generally bedaubed with various coloured clays or mud; but in reality the true colour is a deep greyish black. In the domesticated animal it is certainly much darker, which is due to constant washing, grooming, and anointing with oils.

The looseness of the skin is familiar to all, and as is the case with many other animals, it may be freely moved at will through the aid of a special muscle, the *panniculus carnosus*, lying beneath it. The action of this muscle is frequently demonstrated when the creature is tormented by flies. Some elephants have a bad habit of shifting their gear, or load, by frequently bringing this muscle into play.

The skin is of considerable thickness, but varies in different parts of the body. It nevertheless does not prevent its being highly sensitive—a matter of common remark—mosquitoes even causing extreme irritation, and it is this fact which explains why in the natural state we find these animals habitually besmeared with mud.

Weight of carcass.

Gilchrist gives the weight of the carcass of an ordinary-sized elephant as follows:—

“In conducting the weighing of the carcass in portions, as stated below, every regard was paid to ensure a correct result, and I consider the one given to be within a very few pounds of the exact weight of the living animal:—

				Cwt.	qrs.	lb.
Head (including brain, which weighed 16½ lbs.)	...	...	...	4	0	22
Left fore-leg	...	...	...	2	2	25
Right fore-leg	...	...	...	2	2	14
Left shoulder	...	...	...	0	3	18
Right shoulder	...	...	...	1	0	7
				<hr/>		
Carried over	...	...	...	11	2	2

				Cwt. qrs. lb.
Brought forward				... 11 2 2
Left hind-leg...	...	...	...	... 2 2 11
Right hind-leg	...	...	...	... 2 3 0
Left ribs	...	...	...	... 1 1 20½
Right ribs	...	...	...	... 2 0 26
Loins and part of buttock	...	...	...	... 3 0 16
Pelvis	...	...	...	... 3 1 19½
Neck	...	...	...	... 0 3 13
Breast-bone	...	...	...	... 0 3 0
Heart	...	...	...	... 0 1 14
Lungs and diaphragm	...	...	...	... 0 3 14
Kidney	...	...	...	... 0 0 16
Intestines (small and large bowel)	...	...	...	... 2 1 23
Liver	...	...	...	... 0 2 20½
Spleen	...	...	...	... 0 0 4½
Stomach	...	...	...	... 0 3 12
Weight of carcass and organs				... 34 1 12
Dung weighed	...	...	...	... 2 1 0
Water in bowels and cavity of abdomen, about	...	...	...	... 2 1 18
Total weight				... 39 0 1
Pounds, Avoirdupois	...	...	...	... 3,369

The dimensions of the animal were as follows :—

				Ft. in.
Height	...	...	...	... 7 4
Length from top of forehead to insertion of tail	...	...	...	... 10 1
Round abdomen	...	...	...	... 13 8

Length of intestines—

Small intestines	...	...	...	... 68 0
Large intestines	...	...	...	... 38 3
Total length of intestines	...	...	...	... 106 3

“Skin about $\frac{3}{4}$ of an inch to 1 inch thick, thickest about the loins and buttocks.

“Depth of the carotid artery from the surface of the neck, 4 inches; diameter of the carotid artery, $\frac{3}{4}$ of an inch.

“Jugular vein in close proximity to the carotid artery, about $\frac{1}{2}$ an inch. The dimensions of the animal, taken while alive, will show the carcass thus weighed, piecemeal, was of more than average size.”

CHAPTER IV.

ON THE CAUSES AND PREVENTION OF DISEASE—GENERAL TREATMENT OF SICKNESS—
GENERAL INDICATIONS OF ILL-HEALTH.

On the causes and prevention of disease.

BEFORE entering upon a description of the diseases, I would like to offer a note of warning to those who employ these creatures. Though a certain amount of predisposition to disease may be assigned to a change from freedom and a natural life to domestication and an artificial one, and to accidental causes which cannot perhaps be anticipated and accordingly prevented, there undoubtedly is a very considerable amount of disease which can be directly attributed to conditions to which the domesticated animal is subjected, and which, with proper care and humane consideration, can be greatly or wholly avoided. Twelve years' experience in this province, during which time I have had abundant opportunities for observing domesticated elephants and their treatment by masters and mahouts, has compelled me to believe that in many instances (and I say so with reluctance) a maximum amount of labour is exacted with a minimum regard bestowed upon their wants and creature comforts—in other words, they are "sweated." This failing is mainly due to ignorance on the part of supervisors with regard to the habits and peculiarities of their charge, and consequently they are incompetent to criticise the actions of mahouts and attendants.

Employers seem to gauge the capacity of the animals for work by their huge bulk and strength, and imagine that their constitutional strength is commensurate, or fail to give this important matter its due consideration. The result of these shortcomings, whether the neglect be wilful or due to ignorance, is shown by the only too frequent ill-health tame elephants suffer from.

To illustrate these remarks let us consider the following points:—

- (a) The fact that he is a *nocturnal* animal is often lost sight of, and that in his wild state, during the day he seeks those haunts in the forest which are cool and shady and afford the best protection from the heat; but as soon as he is domesticated he has to acquire a tolerance to the direct rays of the sun. This in itself constitutes much discomfort which is demonstrated when an animal is tethered for any time in the sun. Any one familiar with

his habits must have repeatedly noticed the manner in which he piles fodder, or a blanket if handy, or other things on his head and neck, or if such be not available, he throws dust over himself, or if working, frequently inserts his trunk in the mouth, withdraws fluid and squirts it over his body, but it is not everyone who has to deal with him who appreciates the significance of these acts. How often has an elephant been seen working in the sun, in a Government or private timber-yard, provided with any head protection? One does occasionally see a careful mahout take off his turban or coat and throw it over his animal's head.

- (b) It is difficult to lay down fixed rules as to the amount of work which may be exacted. This must necessarily depend in some measure upon individual idiosyncrasies and constitution, which can only be ascertained by the careful observation of those in attendance (supervisors, &c.). What would undoubtedly prove moderate work in one individual might prove excessive in another, though to all appearances of equal size, age, and condition. Again, the early symptoms of failing vigour which should be recognized by the mahouts, are either not reported by them, or often after having been reported, are paid no heed to by those in authority. I can call to mind instances in which an animal palpably suffering pain and going lame, was found working. Regrettable as it is, the sufferings of an animal that may have toiled for years in his master's cause and contributed materially to his fortunes are passed unnoticed. Too often, therefore, it happens that an animal's energies are overtaxed to such an extent that he suddenly breaks down. So far as one can frame rules, I would strongly recommend that during the hot weather, from 15th February to the breaking of the rains, no animal should be worked in the open after 10 A.M., and never before 3-30 P.M. Moreover, they should never be worked more than three hours at a stretch without being given half an hour's interval or rest in the shade, during which time the gear should be loosened, parts examined for galls, and a little water and some bundles of fodder presented. I consider it imperative for humanity's sake that employers should detail, whenever possible, a European assistant to frequently (at least three times a week) inspect and report upon the health of the animals, their physical capability

for work, also the sanitary condition of their surroundings, and above all the quality and amount, *by weight*, of fodder supplied.

- (c) I have already dealt with the subject of food, but as this is so important a matter, the remarks beginning on pages 23 and 27 will bear some repetition and addition.

In addition to a plentiful supply of good food being essential, it must also be varied; but here again the conditions of food-supply in Rangoon, as I have observed, do not agree with my ideas on the subject; for instance, the basis of their diet is composed of a species of rush called by the Burmans *wet-la* (*Paperus pangoree*, *Cyprus tegetum*), which is one of the least nutritious kinds of fodder that could be supplied, as it is full of watery sap. It therefore follows that for a creature to derive sufficient sustenance from it, a very large bulk must be ingested which unduly taxes its digestive capabilities; added to this, being cut in stagnant marsh lands, it may have adhering to it the ova of many varieties of noxious intestinal parasites, as well as germs of disease, and is often provocative of diarrhœa. Thus, for want of proper supervision, it usually happens that a considerable quantity of dead stalks and other unwholesome material, is mixed with it. I have observed that usually the custom is to allow so many bundles for each animal, but I have never seen yet a European supervising the *weighing* of the fodder to ensure that each animal receives an adequate allowance, which I have often found was not the case. How often is any other kind of fodder supplied? I fully realize why this food is presented year in and year out: it is undoubtedly the easiest procurable near Rangoon, but with a little more trouble and very little extra expense, if employers would insist upon it, far superior fodder could be and should be substituted or mixed with this *wet-la*.

To sum up then, the elephant is far too much in the hands of his mahout, receives insufficient supervision, and I venture to state that were more consideration given to the above remarks, more work could be exacted, better health maintained, and there would be less need to refer to the subsequent pages.

General treatment of sickness.

It will be as well to remark here that elephants generally are bad patients from three points of view: (a) they are naturally very timid, suspicious creatures, difficult and often dangerous for strangers to handle; (b) their vital processes are slow, hence diseases run a protracted course, take on a low form, and loss of condition is only slowly regained. Their natural timidity in health is often augmented

by disease; they very readily lose heart, becoming indifferent or oblivious to their surroundings in serious ailments; and (c) the difficulty often encountered in the administration of medicines.

If successful treatment is to be achieved, these facts must never be lost sight of, everything calculated to frighten the patient should be as far as possible avoided, and every effort to conciliate and gain his confidence employed, in preference to any method of restraint to effect one's purpose. Restraint in any form increases his fears, stimulates him to offer resistance, and exhausts his energies. For this reason I advise that the details of treatment laid down by the person in charge, should be carried out under his personal supervision, through the agency of the mahouts alone.

(1) *Rest*.—Whenever any indication of ill-health, however trivial, is observed, the first step in treatment is to rest the animal, and by rest I mean that except gentle walking exercise if not lame, the animal must be tethered, and not allowed to travel or work on any pretext whatever, until such time as the person in charge is satisfied that the animal is fit to do so.

(2) *Shelter*.—During the hot season a cool and shady standing must be selected. In the rains he must be kept out of the wet, and not exposed to cold winds. Should an animal show signs of chilliness, some sort of covering must be thrown over him, or massage may be practised. Burmans, Karens, and Shans usually employ this latter method, which they perform with their hands and feet and appear to afford the patient comfort.

(3) *Food*.—All grain ration must be withheld. In most diseases the appetite is partially or wholly lost, and it is therefore necessary to tempt the patient with some favourite fodder, small quantities of which should be presented frequently, such as leaves and boughs of favourite trees, well-known to attendants, plantain stems, bamboos, maize or millet stalks, in or out of ear, sugarcane or fruits such as pineapples, plantains, bael, green cocoanuts, &c.,—in fact anything that he can be enticed to eat.

(4) *Drink*.—Unless the water-supply is in the immediate vicinity, elephants should not be taken long distances to drink or bathe, but arrangements must be made to carry this out near the standings. It is always desirable to have a tubful of fresh clean water as well at the standing. As much *freshly** made cold gruel as they will take should be offered in bucketfuls.

(5) *Excretions*.—The dung must always be carefully examined daily, and especial attention paid to the *early detection of parasites* which are so small as to be easily overlooked. Many animals die every year from want of attention to this important matter, parasites

* Gruel rapidly turns sour in this country.

often not being detected until the animal is passing them in thousands, has serious diarrhœa, and has become so enfeebled as to render treatment futile. The urine too must be daily examined, and departures from health as laid down under "Urinary system" reported.

(6) *Standings*.—Important as it is under ordinary circumstances to keep standings and surroundings in a thoroughly clean state, it is still more necessary to do so during any sickness. Offensive gases emanate from collections of dung, litter, which are themselves unwholesome, and these in addition attract flies, causing annoyance to the sick creature, as well as materially aiding in the spread of infection. When disinfectants can be procured—and there are many inexpensive ones on the market—they should be freely used to purify standings. Once a week the sick animal should be removed to a fresh standing if it is only 30 or 40 yards distant. It is also a wise precaution to isolate all sick animals. All animals suffering from wounds and abscesses should, as much as possible, be kept on standings free from sand, dust, owing to the habit they have of taking up dust and dirt in their trunks and blowing it over wounded surfaces.

(7) *Convalescence*.—When once an animal has regained a certain amount of strength so that he is able to roam about, he should be taken to the jungle, sufficiently fettered to prevent his being lost, and let loose. By this means an animal has the opportunity of satisfying his own inclinations with regard to the nature, quality, and quantity of his food, and I know of no method of treatment that will advance and restore his usual health and vigour with the same rapidity.

General indications of ill-health.

After what has been said about the elephant in health (*see* page 9), it will be as well, before discussing individual diseases, to enumerate some of the major indications of indisposition commonly displayed:—

(1) *Dullness*.—This is probably the first indication likely to attract notice, and is shown by the cessation of those restless movements of the trunk, ears, limbs and body so characteristic of health, and could at once be detected by any observant attendant. This symptom is evinced in all constitutional disturbances, especially the acute diseases. It is also manifested in many local conditions, unless of a trivial character, the detection of which should call for an immediate investigation concerning the temperature, pulse, respirations and excretions.

(2) *Fever*.—The temperature of the elephant is in health 97 degrees and a fraction over, rarely 98 degrees. Anything above this constitutes fever, and a temperature of 100 degrees indicates

considerable fever in these creatures, and a rise of 4 or 5 degrees a grave condition. Fever, it must be distinctly understood, is not a disease in itself, but merely a symptom of disease, and may arise from manifold conditions. It accompanies almost all acute constitutional ailments resulting from whatever cause, such as anthrax, foot-and-mouth and kindred diseases, heat stroke, chills, blood poisoning, &c., but may also attend conditions which are purely local, such as an abscess beneath the skin, inflammations, wounds and other injuries. Fever is ascertained by taking the temperature in the rectum or fundament; but this is sometimes by no means the easy operation that it is in other animals, owing to the extreme suspicion and nervousness displayed. The method recommended is as follows: Many elephants are not averse to having the contents of the rectum evacuated artificially, *i.e.*, by inserting the arm and raking out the dung; the arm should previously be anointed with soap or oil. A good mahout can do this and at the same time having removed some dung can introduce the thermometer without arousing suspicion. With caution this is the simplest method I know of, and an ordinary clinical thermometer may be used; the elephant may be standing or recumbent. This method failing, the only alternative and much more troublesome means, and with ill-tempered animals not always successful, is as follows: The elephant must be made to assume the recumbent position. One or often two men are required to hold the tail aside; a longish thermometer about 12 inches is desirable, and for economical purposes it is as well, in order to avoid breakage to use one of a special pattern guarded by a metal case;* but it must be borne in mind as a standard rule which on no account should be relaxed that after the use of such an instrument, the thermometer must be withdrawn from its special case and thoroughly cleansed in disinfecting fluid, whilst the case itself must be boiled for some minutes. It is sufficient to thoroughly wash an ordinary clinical thermometer in some disinfecting solution. These precautions are imperative to obviate the risk of infecting sound animals.

As the anus or fundament is surrounded by much loose hanging skin, special care must be observed to see that the hand with the thermometer, or thermometer alone, previously anointed with vaseline or other lubricant, is inserted for at least 6 or 8 inches, where it should be permitted to remain for at least three minutes in order to obtain a reliable reading.†

* These I specially recommend and are advertised by Messrs. P. Orr and Sons, but may be obtained from any surgical instrument makers, such as Messrs. Arnold and Son, West-Smithfield, London.

† Half minute thermometers are much handier and owing to their delicacy only require a little extra care.

In order to efficiently conduct the operation, one good method is to divert his suspicion by going through the operation of harnessing and loading him, and at the same time to offer sweetmeats, sugarcane. Care must be taken to observe that the mercury in the thermometer is shaken down below 97 degrees before handing the instrument to the mahout, who alone should be entrusted to insert it.

Should no thermometer be at hand, there are other indications which may lead one to a correct conclusion as to the presence of fever; these are (*a*), shivering often passed unnoticed, is frequently a precursor of fever, (*b*) uneven surface temperature of the body, *i.e.*, either the trunk, ears, or extremities may be cold whilst the body is hot, or may be alternately hot and cold, and the skin of the trunk contracted and shrivelled, (*c*) loss of appetite, (*d*) dryness of mouth and evident thirst, (*e*) constipation, (*f*) scanty and deep coloured muddy urine, (*g*) unusual redness of the membranes of the mouth and palate, (*h*) watery and reddened eyes, (*i*) acceleration of the pulse, which normally beats from 46 to 50 per minute, (*k*) change of colour of skin which becomes lighter, and any white spots about trunk, becoming paler.

Treatment.—It has been already pointed out that fever is a symptom and not a disease, and this being borne in view, the first indication in regard to treatment is to ascertain if possible its cause, and when this is found, to remove it. Until the cause has been discovered one's energies must be directed towards reducing the temperature to normal limits, and this may be effected in the following ways: First as a matter of routine, a brisk purgative should be given and the bowels must be kept open throughout the attack, *i.e.*, there should be some action of the bowels daily, *see* Appendix 23 to 38.

It must, however, be understood that after a strong purgative, reaction frequently occurs during which no dung is passed for several hours; should this extend over a day, a repetition of the dose may be given, but in a much milder form, or better still, enemas may be employed to bring about action of the bowels.

In addition to the instructions laid down for general treatment of sick elephants the following prescriptions may be tried:—

Nitrate of potash and	} of each half an ounce, in water or bolus.		
Chlorate of potash			
Nitrate of potash,		half an ounce	twice a day; given mixed in a couple of buckets of water.
Camphor and	} of each half an ounce once or twice daily.		
Nitrate of potash			
Aconite leaves powdered	...	...	... 3 drachms.
Calomel	...	...	... 6 drachms.
Jaggery	...	...	... 8 ounces.

divide into eight pills; give one every night. Also *see* Appendix—Diuretics, Nos. 16 to 22, and "Mussauls."

(3) *Pain*.—This may be suspected when the animal groans frequently without any evident reason. Its locality is sometimes revealed by the behaviour, as for instance, when pain is in a limb, that member is favoured, evidenced by being lifted with caution or carried stiffly during progression; if in the abdomen, manifest uneasiness is shown by frequently lying down and getting up, or by biting the trunk or keeping the tip in the mouth for some time.

Treatment.—May be local or general. The former is best practised by the application of heat to the part and hot-water is usually the handiest and best agent to use, also see Appendix No. 76, and for general treatment, see Appendix 1 to 6.

(4) *Appetite*.—May be partially or completely lost, or may be depraved as shown by eating earth, which symptom must be carefully distinguished from a custom amongst many wild animals which visit so-called "licks" and eat earth to obtain salt.

(5) *Debility*.—Like fever, is a symptom indicative of disease rather than a disease *per se*, and may be brought about by a multiplicity of causes which may be of a very variable nature, and may be summed up as follows.

Causes.—(a) *Condition of life*.—From liberty to captivity necessitating as it does an artificial in lieu of a natural existence.

(b) *Diet*.—Food may be insufficient in quantity, lacking in quality or variety. Salt, a most necessary ingredient, may not be allowed, or if allowed may be insufficient, often being appropriated by the attendants (a very frequent fault).

(c) *Overwork*.—Either as regards overtaxing of strength, or to mild work carried on for many hours at a stretch, and therefore curtailing the time for feeding, sleep, and rest.

(d) *Insanitation*.—Want of cleanliness in standings, sheds and surroundings.

(e) *Worms*.—That is, internal parasites, by depriving the animal of nutriment, or actually robbing him of his blood.

(f) *Abuse of drugs*.—Gilchrist states that this condition may be induced by the excessive use of mercurial preparations which some mahouts undoubtedly are fond of employing.

(g) *Suppurating wounds*.—When these are extensive or chronic, the constant discharges issuing therefrom causing a drain on the system.

Debility in some degree must of necessity accompany all constitutional ailments, and is the outcome of profound changes in the constitution of the blood. Every one must have heard the adage "blood is life"; it necessarily follows that the vitality and nutrition of every structure, and organ, of the body must depend on the quality and quantity of this fluid supplied to them. When this is

lacking in quality or quantity; the organs and vital processes from poverty of nutriment are unable to perform their functions as satisfactorily as in health. Debility is directly therefore the outcome of depravity of the blood, and is shown in very many ways.

Symptoms.—*Weakness*—Which may vary from mere listlessness, restlessness at night and unwillingness to work, to prostration or utter helplessness.

2. *Anæmia*—(bloodlessness) which may vary from slight pallor of the mucous membranes, to extreme blanching.

3. *Emaciation*—Which may only be so slight that the natural depressions and projections of the surface are accentuated, or so pronounced that the beast becomes a skeleton.

4. *The heart*.—Owing to the inferior quality of blood supplied for its own nutrition, becomes weakened and unable to perform its functions satisfactorily, hence those parts furthest removed, especially the tail, and those with paucity of circulation, the ears, may suffer ulceration or actual destruction (mortification). The pulse becomes weak; respiration is hurried, the animal pants on the least exertion and if pressed may drop dead (heart failure); dropsical swellings *thut* (αῖμα) frequently occur owing to the watery condition of the blood permitting a leakage or sweating of this fluid through the walls of the vessels into the tissues surrounding them. The fluid then by force of gravity occupies the most dependent parts. In the case of cavities, such as the abdomen, it may collect in large quantities constituting what is known as dropsy. Gilchrist and Forsyth have noted that sores and extensive sloughing of the external genital organs sometimes occurs as a result of this dropsical effusion into the tissues. I noticed this condition in one case of debility in a female.

The impoverished state of the blood and feeble circulation may sometimes produce sloughing or mortification of the ears and end of tail.

5. *The digestive apparatus*—in like manner suffers, and in consequence we may find loss of appetite or depraved appetite, fœtid breath, and not infrequently diarrhœa of a fœtid character.

6. *The urinary organs*—from the same cause fail in their functions and the characters of the urine may become altered. It may be excessive and clear, or scanty, white and syrupy.

7. *The skin*—too, partakes in this general alteration. We find it rough, harsh, scurfy, and unduly wrinkled; the hair is readily removed, especially that on the tail, or may fall out; sores may break out on its surface and swellings occur beneath it, such as an eruption of boils, particularly on the belly and knee joints, in the condition known to Indians as *sukka zahirbad* (i.e., where dropsy is

not a pronounced symptom). The boils may or may not burst. Burmans anxiously watch for the boils to come to a head and burst, if they disappear without bursting they give the animal up.

Debility as seen in its most aggravated form exhibits a train of symptoms almost exactly coinciding with those recorded by many authors under the name of *zahirbad*.

Whether this is a specific disease or not, as some would have us believe, is a matter of doubt, but the very symptoms noted to characterize that disease are met with in cases of debility, pure and simple.

In many ailments of the elephant there is a marked tendency to glandular enlargements, swellings, and in my experience I have come into contact with cases of debility, pure and simple, which have advanced so rapidly that it has led me to think, as it may have done others, that there was some specific cause, but have failed to discover it, such as "surra" and kindred diseases. When a number are attacked simultaneously, such suspicions are no doubt justified, but at the same time it must not be lost sight of that the defective conditions in general management, feeding, shelter, may have been shared by all and therefore all may suffer alike.

Owners might help in clearing up much of the present obscurity by sending me or other persons with some knowledge of bacteriology, specimens of the blood in fatal cases, the instructions concerning which have been fully laid down under 'Diagnosis' in the Chapter on Anthrax, page 89.

Preventive treatment.—It follows from the remarks made with regard to possible causes that enquiries must be made into every detail concerning recent general treatment and correcting anything at fault. Early recognition is of the first importance, and any animal found the least out of condition should be given a rest by sending him away into the jungle.

Curative.—(a) *General.*—Rest from work, gentle walking exercise morning and evening according to strength. The body must be washed daily and kept thoroughly clean. The state of the bowels must be watched, and any tendency to constipation corrected by administration of laxatives, *see* Appendix—Laxatives or aperients, Nos. 23 to 28, or Enemas, Nos. 77 to 80.

Thirst should be relieved by always keeping a tub of fresh water near the standing. A liberal allowance of good food, which must occasionally be varied, and also an allowance of salt is necessary, in addition to which tempting diet such as sugarcane, fruit, may be given with advantage, as also wheaten cakes or *chupatties* or bread, 5 or 6 lbs., morning and evening. Diuretics, *see* Appendix 16 to 22, may be tried, and if the appetite is bad, Cordials, *see* Ap-

pendix 11 to 15, and stimulants such as rum or whisky in six-ounce doses twice or thrice daily should be given. During convalescence a course of tonics is indicated, especially the preparations of arsenic, iron, or copper, mixed with vegetable bitters or aromatics, *see* Appendix Nos. 39 to 46. Also dilute nitric acid in doses of one to three drachms in a bucket of water, or dilute sulphuric acid in similar doses once daily, or iodide of iron in two drachm doses once a day.

If worms are the cause, for treatment *see* Appendix Nos. 47 to 53.

(b) *Local*.—When the dropsy under the skin of the belly tends to become tense and the area is extensive, the skin may be stabbed in several places to allow the fluid to drain away. This is best done by protecting a knife by winding round the blade, tow, cloth, or string, so as to leave only half to three-quarters of an inch of the blade exposed, so that when stabbing the part, it cannot go deep enough to cause injury. The stabs should be four or five inches apart. This done, the parts should be fomented and afterwards dressed with anti-fly preparations, *see* Appendix Nos. 122, 123, and 128 to 130. A trocar and canula may be employed for tapping the fluid; the trocar should be about 3 inches in length and the canula $2\frac{1}{2}$ inches, the diameter of which should be nearly $\frac{1}{4}$ inch.

CHAPTER V.

ANTHRAX FEVER, OR CHARBON—AVOIDANCE—DISPOSAL OF CARCASSES—VACCINATION—
POST MORTEM EXAMINATION—APPEARANCE OF CARCASSES—ELEPHANT-POX—SURRA—THUT
—FOOT-AND-MOUTH DISEASE—BLOOD POISONING—RABIES—TETANUS OR LOCKJAW—
EPIDEMIC PNEUMONIA—RHEUMATISM.

Anthrax Fever or Charbon.

BEFORE considering the disease as it occurs in elephants, it will be advisable to discuss it as it affects some other animals. From numerous records of the disease and the heavy mortality reported therein, as well as its extreme contagious and infectious character, we have learnt to consider it one of the most formidable diseases we have to encounter.

Definition.—A virulent infective fever caused by the entrance into the blood and multiplication therein of a micro-organism known as the “bacillus anthracis.”

Incubation (That is, period which elapses between the time of entry of the organism into the system and the appearance of its first symptom).—One to several days.

Prevalence.—Certain localities are peculiarly adapted for the development of the disease which recurs in them repeatedly, notably low-lying swampy districts subject to inundation, especially in hot and damp climates, with clay and loamy soils; some areas in these localities, particular pastures, are specially notorious for frequent outbreaks. From these localities the disease may be carried in various ways and infect extensive areas constituting epidemics.

Season.—Outbreaks in Burma among cattle generally occur during April, May, and early part of June, *i.e.*, the advent of the rains, and September and October the close of the rains. At these times there are heavy thunder-storms often followed by intense heat during which time there is a rapid withdrawal of moisture from the soil.

Altitude.—It is rarely met with on any elevated well-drained land.

Sources of infection.—Food and water—

- (a) Food.—In the case of carnivora, the flesh of animals that have died of the disease.
- (b) In herbivora, fodder or water which has been infected by discharges from affected animals or carcasses.

- (c) *Respiration*.—The spores of the organism may be carried by the wind and thus taken in with air to the lungs.
- (d) Local wounds and sores may be infected by being brought into contact with the anthrax poison either through the discharges of infected animals directly, or through the agency of flies, or suctorial insects, that have either settled on infected material, or have bitten infected animals.

General symptoms.—The most characteristic features of the disease consist of the suddenness of the onset, accompanied with violent shiverings or twitchings, early pronounced prostration; the very aspect of the animal, which it is impossible to describe, but which once seen will not be forgotten, denotes the gravity of the seizure; fever, which rapidly becomes high, bleeding from the mucous membranes, evidenced by purplish spots and blotches on the mouth and palate, or by blood-stained discharges from the mouth, anus, or bladder. These symptoms run a severe and rapid course and are usually succeeded by a fatal issue in from one hour or less, to several days, according to the virulence of the poison, or more rarely to recovery. Over and above these ordinary symptoms may be seen those arising from local conditions—

- (a) The lungs, shown by distressed breathing which may culminate in suffocation.
- (b) Intestinal colic, with often urgent diarrhoea, attended with voiding of dark liquid or blood-stained evacuations.
- (c) Nervous system, in which spasms, wild excitement, extreme listlessness or insensibility, paralysis with tottering gait, and convulsions ending in death.
- (d) *The skin*.—Rapidly formed swellings or tumours localized or diffused beneath the skin which may either precede or succeed the advent of fever, and which are at first hot, painful, and doughy, but later become cold and painless, and which on incision are found to contain a jelly-like material but never matter. The swellings are more frequently seen behind the jaws (parotid glands), between the limbs, groins, on the front of shoulders, belly, or hind-quarters; sometimes sores on the skin.

As regards the disease in elephants it will be sufficient to observe that all degrees of severity and diversity of symptoms may be met with. It frequently happens that the most virulent forms are encountered during the early period of an outbreak. Sometimes death ensues so rapidly without any symptoms having been noticed, that it has been attributed to apoplexy, heat-stroke, lightning-stroke,

and snake-bite. During the rains, when anthrax is prevalent, occasionally more or less sudden deaths are recorded in which the mouth, tongue, and throat have been observed to be in a diseased state, which symptoms have been attributed by Burmans to a black hairy caterpillar which is common at this season of the year in certain localities where they often do immense damage to teak and other trees. Burmans state that if an elephant takes up one of these creatures with its food death will result. In the same way similar cases in horned cattle have been ascribed to this caterpillar, but these cases are often cases of anthrax. I have handled the caterpillar and have not suffered except some slight irritation.

Prognosis.—Most unfavourable: Friedberger and Fröhner give the average mortality amongst domestic animals from 70 to 90 and even 100 per cent. in the worst types (*i.e.*, apoplectic). After an epidemic has continued some time the disease may assume a milder type and recoveries without any treatment are not very rare.

Diagnosis.—Though it is highly important to readily recognize anthrax, it is in reality often a most difficult matter owing to the variation in symptoms, or owing to a fatal issue arising without any symptoms at all having been discovered. Again, it is often difficult in dealing with isolated cases. When some of the more important symptoms enumerated above have been detected there is less difficulty in pronouncing the character of the disease. Positive diagnosis can only be made by finding the anthrax bacillus in the blood through the aid of the microscope. If anthrax has been prevalent in a locality previously, and sudden deaths occurred among cattle at the same time as among elephants, or if elephants have grazed in places where carcasses have been known to be buried, the disease may be suspected to be anthrax.

When anthrax is suspected as a cause of death, thin cover glass preparations should be made and sent in at once for examination. Cover glasses may be obtained at any chemists, and officers should be supplied with them. I shall only be too glad to examine any specimens sent to me.

One important point to remember is, that all preparations to be any good must be made as soon as possible after death, as the bodies of animals dead of this disease soon undergo decomposition.

To prepare specimens, a minute quantity [half a drop] of blood, or pulp from the spleen or other organs, or jelly-like diseased material is taken on the point of a needle which has just previously been heated in a flame. The material is placed between two cover glasses, which are to be pressed gently together in order to expel any excess of material, and to leave a very thin layer between them, they are then to be separated by sliding them gently one over the

other and allowed to dry under a watch or wine glass to exclude dust, or the layer may be fixed by taking the cover glass, coated surface uppermost, between the finger and thumb, and passing it rapidly two or three times over the flame of a spirit lamp. When dry, they should be carefully packed in cotton wool with slips of paper intervening and placed in a small wooden box, and for extra protection this box should be again packed inside a tin one to ensure safety. About half a dozen specimens should be sent. All cover slips must be boiled and cleaned and kept in some disinfecting fluid—carbolic acid (1—50) prior to use.

Microscopical examination of the blood after death will afford a correct diagnosis, and a *post mortem* examination alone will usually do so. The disease will be best understood by quoting a few illustrative cases. Some of these occurred among elephants at the same time that this disease was raging amongst horned cattle in the same locality.

Case No. 1.—Red spots observed on the mucous membranes, eyes staring, passed blood with the excrement. During illness kept shivering and leaning against trees; after falling he did not rise again. Died on the second day of illness. Putrid smell from the mouth soon after death. Another animal had a short time previously died suddenly near by.

Case No. 2.—One morning an animal to all appearances well, was saddled, loaded, and started from camp; she had only gone a short distance, when it was observed that she was not walking properly, *i.e.*, signs of weakness behind were evident; she suddenly stopped, and refused to go on, so was turned to return to camp, but in a short time she fell down; the baggage and *kah* (basket) ropes were cut through at once, but she did not rise again, dying in a short time. This elephant had a day or so before grazed over a place where the carcass of an elephant which had recently died had been dragged by two elephants for about a mile for burial.

Case No. 3.—Three elephants, namely, Nos. 100, 101, 103, were working in the same creek. These elephants had worked through the hot weather; they had a day off after every three days' work. Grazing was scarce; they lived chiefly on dry bamboo, and were given a liberal ration of paddy daily. The drinking water was taken from shallow wells freshly made; the water, however, was described as putrid and offensive; and that in which the animals were bathed was stagnant. It had rained for a couple of days prior to the first elephant being attacked.

On the morning of the 5th May, No. 103 was noticed to be out of sorts, so was not sent to work; after receiving some medicine he was set free to graze. In the evening, when brought to water, he was observed to be much worse; he drank as usual, but his ears and

body were cold, and he was very dull. His mahout took him into the jungle, and during the night he was observed to fall once and lie down several times; in the morning he was standing alongside a clump of bamboo looking very sick; his mucous membranes were yellow, trunk swollen, and he was unable to move; he dropped and died. This was on the 6th May. Cause of death supposed to be sunstroke, but proved to be anthrax.

The remaining elephants were thrown out of work rested for a few days and were then moved to another creek.

Case No. 4.—On the morning of the 18th, No. 100 was found dead and was buried where he died. Death was reported to be due to anthrax. No signs of illness were manifested.

Case No. 5.—On the morning of the 23rd, No. 101 was found dead. This elephant was fettered, set free to graze the evening previous apparently well, and was found dead within a few yards of where No. 100 died.

Three elephants were stationed together Nos. 9, 10, and 11.

Case No. 6.—No. 11 when seen on the morning of the 5th June was to all appearances well; he was let loose to graze: In the evening he was noticed to be very dull, trembling, ears cold, eyes bluish, appeared unable to see, did not obey orders, breathing very hard. In 15 minutes or thereabouts his hind-legs suddenly gave way under him; he fell, was delirious, and soon died.

Case No. 7.—No. 10 had done no work for some months, as he was being treated for a sore; he was seen on the afternoon of the 6th of June leaning against a tree shivering; on inspection he was found to be dull, a swelling was observed behind the jaw, took no notice of his keeper, and later on became delirious; his hind-quarters were weak; he tried to move away, but fell forward and soon afterwards died. In about an hour the body was noticed to be enormously distended. This elephant died at a place $1\frac{1}{2}$ miles distant from where No. 11 died.

Case No. 8.—An elephant which was apparently quite well the previous evening was next morning observed to be very ill: the ears and legs cold, body hot, breathing hard, trunk swollen, eyes staring; blood was noticed on dung that was passed; when made to move his hind-quarters swayed to and fro; he dropped, and died in convulsions. Soon after death the body became greatly distended and blood was observed passing from the natural openings. The rectum was everted, dark in colour, and presented the appearance of a tumour.

Case No. 9.—On the morning of the 10th October, the mahout went out to catch his elephant; on finding him he observed that the animal was sick, his breathing was distressed, there was swelling

behind the jaws and also on the belly, and the trunk appeared swollen, especially in its upper portion; on trying to take the animal to water he seemed very weak. He was left under a bamboo clump. In the evening he was worse, was very dull, the trunk flaccid, breathing very audible. Next morning he seemed no worse, refused food, and, though he took water in his trunk, appeared to have some difficulty in swallowing. He died about 3 P.M.

Case No. 10.—On the 31st July this animal while out grazing was found in the morning standing perfectly quiet amongst some bamboos, he was made to move a few feet with difficulty, and it was noticed that he had a large swelling called “*thut*” by the Burmans, extending from between the fore-legs on to the belly and sheath of penis; he was given water, which he drank; during the day another small swelling was noticed on the hind-quarter; he passed some foetid liquid motions and also urinated in small quantities during the day: swellings were treated with mixture of turmeric, &c. 1st August.—No sleep during the night, ate and drank a little, passed liquid motions, animal very drowsy, listless, and stiff; swellings no better. 2nd August.—Died early this morning.

Cases Nos. 11 and 12 are quoted from Frost.

Case No. 11.—This is the third elephant that has perished at this depôt within twelve days. Case 1 died after a short illness. She was seemingly in perfect health on the evening of 14th June, and died about 3 or 4 A.M. on the 15th. I did not attempt a *post mortem* examination, but merely examined the contents of the abdomen as removed from the body. In this case nothing attracted my attention save large abscesses in the liver, which I thought sufficient to account for death. Case 2 died on the 22nd; no *post mortem* held. Case 3. The following are the symptoms which were given to me by the sergeant in charge of the animal. The first symptoms of sickness were noticed on the morning of the 23rd instant in the shape of a lameness of the front and hind leg, left side. During the day it refused all food (Colonel Hawkes corrects this and states it ate a little food); no sleep at night. On the 24th left side improved by fomenting with hot water. Refused all food, and kept lying down and getting up at irregular intervals throughout the day and night; slept very little and ate no food. Administered a purgative through the medium of plantains and boiled rice, which slightly acted on the system, the excrement being mixed with slime. On the 25th the animal grew worse; no sleep, no food, lying down and getting up till about 3-30 P.M. Appeared during the day to be in pain, as the animal was noticed sitting on its haunches and biting its trunk; passed urine once yesterday. At 4-30 P.M. it expired.

P.S.—During the day a large swelling formed behind the left ear.

With the exception of the *P.S.* I do not think there is much value to be attached to the symptoms quoted. Colonel Hawkes adds that the tumour formed very rapidly.

The symptoms which I noticed were not characteristic ; pulse 68, pupils dilated to their fullest extent, breathing hurried, animal down and very uneasy.

Case No. 12.—The following symptoms were detailed by the sergeant in charge. 27th of June 4 P.M. was observed to be limping when brought from shed to feeding-place ; ate rice and straw ; no sleep during night and ate very little. Favoured left hind-leg on account of pain. 28th of June, swelling on right of penis was observed early this morning ; animal drags left hind-leg ; ate *churah* freely from 9-30 to 10 A.M. Urinated at 9-45 A.M. ; urine of whitish colour, but without pain ; ate and drank and seemed better. 29th June.—No sleep during night ; swelling increased ; grew worse between 8 and 9 A.M. Tumour greatly enlarged since morning. At 9-10 A.M. lay down, biting trunk from pain. About this time Veterinary Surgeon Frost opened the tumour. Elephant died at 10-10 A.M.

Treatment.—From the above remarks, especially with regard to infection and contagion, easy transmission to man, and high mortality it will be readily grasped how dread and important is the nature of the disease, and from the fact that no specific remedy has been discovered of any avail in treatment, it follows that the most important way to combat the malady lies in prevention. *Firstly*, then, preventive treatment will be discussed, after which attention will be given to curative measures.

Avoidance.

Before halting at a village it is as well to ascertain from villagers or herdsman the state of health of their cattle ; should there be disease prevalent and anything indicative or suspicious of anthrax (the names by which it is ordinarily known in Burma are *daungthan*, *gyeik-na*, *hawk-na*, *yine-na*, and *apu-shut*). It is better not to halt the elephants near the village, but at some convenient place well away. If this is not feasible, it is necessary to observe the following precautions, namely, to tether the animals on the highest ground available, and to allow no strange animals in the camp. On the march it is wiser to avoid all tracks frequented by cattle drovers ; fodder and water must be brought to them ; the former, if grass be given, should be cut well above the ground, and rushes, reeds, and swamp grasses on no account permitted. It is even better to restrict the fodder to boughs of trees, bamboos, &c. If there

be no fast running stream in the vicinity, it will be necessary to procure water from deep wells. On no account should animals be permitted to wander into cattle grazing-grounds, stagnant pools, or swamps.

When a case has been discovered or is suspected, the affected animal, with its attendants, must be segregated forthwith at a distance (a quarter mile) from water-supply and public roads. The healthy animals should, if numerous, be divided into batches two or three in each and sent off without delay to the highest ground near at hand. To facilitate inspection these elephants should be picketed only a few hundred yards apart. Inspection should be carried out at least once daily and the temperature of each animal taken. Any animal showing a rise must be promptly removed and treated as already laid down, which treatment has proved successful on more than one occasion in my experience when the outbreak was checked forthwith. Attendants on suspicious or diseased animals must not on any pretence approach or attend to the wants of healthy animals.

All refuse, dung, &c., should be mixed with some strong disinfectant, removed without delay and destroyed by fire, or buried in a deep pit. Any gear, ropes, that may have become soiled should be burned, and any ironwork, chains, passed through a fire. The standings are to be kept clean and frequently sprinkled with some disinfectant, and if the animal be removed to another place a deep layer of straw may be spread over the old standing and then fired. Drinking utensils should not be used for other animals unless passed through a fire or thoroughly washed with boiling water. If elephants can be spared, it is a good plan to send them to the hills from 15th of April to the end of June, or for a longer period when convenient.

Should a case of anthrax occur in a shed, if inexpensive, it should be burned. If costly, the walls must be thoroughly washed with boiling water mixed with very strong carbolic acid or phenyle. As the floor becomes soiled with the discharges, it is necessary to remove the earth to the extent of 2 feet at least, throw in new earth and disinfect the whole standing. The shed should not be occupied for some little time. All posts and other wood should be washed with strong carbolic and later on dressed with tar.

Strange elephants and those that are newly purchased should always be kept separate from the others for a few days.

Disposal of carcasses.

It sometimes happens that an elephant dies at a place where the removal of the carcass for burial is a necessary measure. As a rule a couple of elephants are put on to drag it away. In such cases

all ropes, &c., employed should be burned and chains treated as already noted. The carcass too, should have the mouth, trunk, and anus plugged with tow or old cloth to prevent, as far as possible, any soiling of the ground over which it is dragged. Whenever possible it is a good plan to dig a deep pit alongside the body; when completed the carcass should be tumbled in. There should be at least 4 feet of earth over the body.

Anthrax graves should be fenced in with rough logs, or marked in some special way in order to prevent animals grazing over them, or grass-cutters cutting grass in their vicinity. And here I may add a caution: Burmans, as is well known, are partial to elephant flesh; it is therefore necessary to warn them of the extreme danger of eating anthrax-infected flesh.

Vaccination.

I have been questioned so frequently with regard to vaccination that I have mentioned the subject in detail more for information than with any intention of recommending it. By the practice of protective vaccination the heavy mortality has in certain countries, France, &c., been reduced to less than 1 per cent. Two inoculations are necessary. The first is a weak vaccine. This is followed in from 12 to 15 days by a second, which is stronger. The *second* vaccine matter must *never* be used before the *first*, for the *second* might kill unless the animal had been protected by the *first*.

The vaccinal liquid is sent out in glass tubes, sealed by rubber stoppers, and bear labels "First vaccine matter" or "Premier vaccin charbonneux," usually a red label, and "Second vaccine matter," or "Deuxième vaccin charbonneux," white label. A note is printed on the second vaccine label to the effect that it should be employed 12 days after the first. The vaccine is introduced under the skin by means of a Pravaz or other special hypodermic syringe; behind the ear is about the best place to inoculate an elephant. The elephant having been made to assume the recumbent posture, the hands of the operator must first be thoroughly washed with soap and warm water, and then disinfected, as also the site selected for inoculation, this completed, a portion of the skin is to be taken up between the thumb and forefinger of the left hand, the needle carefully introduced beneath the skin and the contents of syringe injected without force. The metallic wire is removed from the needle and the latter adjusted on the syringe, or the needle may be introduced first and syringe adjusted after. After the contents of the tube have been well shaken the stopper is removed

and the required amount withdrawn. Care must be taken to see that the syringe is working properly. Air bubbles may be removed by holding the syringe upright and gently pressing the piston till a drop issues from the needle. The second inoculation should be made on the opposite side. It is a matter of vital importance that the vaccine be introduced in a pure state; for this reason, if a tube be opened, the contents must be used forthwith. If the whole contents cannot be employed at once, the portion remaining must be dispensed with. It is of equal importance that the syringe be absolutely clean. New syringes are generally safe enough, but one that has been used must be cleaned immediately after the inoculations are performed. In order to effect this, the syringe is taken to pieces, placed in water, and boiled in it for 5 or 10 minutes. Immediately before use it is as well to draw up some absolute alcohol, this will render syringe and needle sterile. Cheap and easily sterilized syringes are procurable from most instrument makers. If the vaccine be not *pure*, or the syringe not *clean*, foreign organisms may be introduced, which may render vaccination ineffective, or, what is still more serious, may give rise to virulent blood-poisoning.

Every care must be taken to see that the *first* vaccine is properly introduced under the skin; for, if this operation be performed hurriedly or carelessly, no protection will be afforded and death may result after the introduction of *second* vaccine.

There is no denying that vaccination is attended with certain risks, owing to defects in the operation, quality of the vaccine employed, and susceptibility of individuals. In *sheep and cattle* vaccination has in some cases resulted in death; in others serious illness, swellings, have followed the operation.

On the Continent the accidents vaccination gives rise to are said not to be so frequent as to cause much alarm. Generally speaking the animals inoculated become sufficiently protected to resist natural and even experimental infection. It is stated that *vaccine sent to a long distance is not easy to preserve*, and in order to obtain really good results it must be used as soon as possible after preparation.

Firms having an interest in, or owning a large number of elephants, and desirous of trying experiments should make some arrangement by which they could on despatch of telegraphic order be supplied with fresh vaccine, syringes, &c. All information and appliances can be obtained from the Director of "The Société du vaccin Charbonneux Pasteur," 14, Rue des Pyramides, Paris.

Arrangements can be made for each tube to contain sufficient vaccine for one elephant. The price of a dose of first and second vaccine is, I believe, 4*d.* to 6*d.*

With reference to vaccination in sheep and cattle, Koch has noted the following points :—

- (a) That if the vaccines are too strong, they may cause fatal charbon.
- (b) If they are too feeble, they do not protect.
- (c) That they do not confer immunity without rendering the animal seriously ill, and that they are consequently dangerous.
- (d) That vaccination may serve to disseminate by rendering animals severely ill from that disease, during which illness they are capable of infecting others.
- (e) That the immunity conferred is insufficient to preserve with certainty from natural infection.
- (f) That the immunity conferred is of too short duration.

Protective vaccination against anthrax amongst elephants was tried in Burma during the early eighties. Unfortunately the records regarding the experiments are very meagre; from those available I find that my predecessor, at the request of the Conservator of Forests, Pegu Circle, inoculated two Government elephants (one full grown and one young animal) on the 7th September 1883, also two cow calves, one buffalo calf, two sheep, one pony and a pig with Pasteur's first vaccine. The temperature of these animals, with one exception, a sheep, was slightly affected, the sheep showing a rise died on seventh day after inoculation from anthrax. On the 23rd the second vaccine was injected. None of the animals showed a rise in temperature over one degree. One elephant had a swelling at seat of inoculation, the elephants were removed to jungle on tenth day after inoculation. The Conservator of Forests would not agree to the proposal to test the efficacy of the inoculation by inoculating with virulent anthrax virus, owing to the great value of the animals. The pony, sheep and pig were inoculated and no ill-effects followed; two unprotected rabbits inoculated with same material, died of anthrax within 36 hours. On the 2nd May twelve elephants, the property of contractors, were inoculated at Zigôn with first vaccine.

On the 15th only nine elephants were brought forward, they each received an injection of second vaccine. One elephant had a swelling at seat of previous inoculation. I regret I cannot trace the further history of these animals.

I believe that the Bombay-Burma Trading Corporation inoculated many elephants about the same time and from what I have heard the results were not encouraging so much so that no further inoculations have been carried out since.

Curative treatment.—With regard to medicinal treatment, the Pharmacopœa has been ransacked, but so far the success attending the use of drugs has not been great. The latest treatment recommended by J. H. Bell, of Georgetown, Demarara, and reported in the Veterinary Record of 21st October 1899, is Formalin. Mr. Bell reports that out of 28 head of cattle treated, 22 recovered; of the six that died Mr. Bell states “we had no hopes of four, and the remaining two, I think, died of having too much Formalin. We found “a (20 minim) solution Formalin (1 in 1,000) injected into the “anthracoid swelling in the region of the jaw had the most satisfactory effect. In from 12 to 36 hours the swelling had practically “disappeared. The injection was used morning and evening for three “days, and then once daily for three days. A draught of *oleum “cinnamon* (1 drachm) *aqua ad* (one pint) was also administered “daily for three days.” Mr. Bell remarks that success in a great measure depends on getting cases early. Formalin is a cheap drug, and can be obtained in Rangoon. Mr. Bell’s report is most encouraging, and the treatment is of easy application. Hypodermic syringes are necessary; and should be of a pattern easily sterilized. The needle of the syringe should be inserted well into the swelling, the contents gently injected, and the needle carefully withdrawn. This treatment is well worthy of a trial, and I trust those firms owning large numbers of elephants will encourage their assistants to try it and submit reports. Recently I tried this treatment in two severe cases of anthrax in ponies, but it proved unsuccessful.

Various methods of treatment have been advocated, from which I have selected those considered likely to prove best which I append:—Hyposulphite of soda 4 to 6 ounces mixed with jaggery, two or three times a day, or carbolic acid 2 drachms, glycerine $\frac{1}{2}$ an ounce, added to two pints of water, twice a day, or pure iodine $\frac{1}{2}$ a drachm, iodide of potash 2 drachms, mixed with jaggery may be given twice a day. If the animal cannot be persuaded to take these, the rectum must be emptied by hand and an enema of carbolic acid 2 drachms, glycerine 1 ounce, warm water four pints, injected every four hours.

Also hypodermic injection—carbolic acid 1 drachm, glycerine 1 ounce. A small incision should be made through the skin and the needle inserted.

Local.—The tumours should be cut into deeply and extensively by a cross incision, freely cauterized with pure carbolic acid and dressed with carbolic lotion (1 in 40), and on redressing the soiled dressings must be placed in a receptacle (never on the ground) and burned under supervision. The receptacle must then be thoroughly cleansed with carbolic solution (1 in 40).

Post-mortem examination.

It is desirable to perform this operation only when it is imperative to establish diagnosis in a suspicious case. No good can otherwise accrue, but on the other hand much harm may be done by soiling hands, cloths, and the surrounding ground.

Before undertaking this operation it must be understood that no attendants on healthy animals should be permitted to handle the carcass or instruments. Some persons who are not likely to come in contact with healthy animals should be selected, and in Burma at least there is no difficulty about this. The men chosen must be inspected carefully, and no one with abrasions or scratches, however trivial, on the skin in any part should be permitted to take on the work. They should be made to rub themselves with carbolic oil (1 to 20), and solutions of carbolic acid (1 to 40) should be at hand to cleanse without delay any cut or wound which may occur accidentally. Any such cut must be dressed and the man forbidden to continue work.

After the operation the men engaged must be compelled to wash their bodies, and especially hands and feet, with carbolic lotion (1 in 60 or 70), or weak phenyle lotion. Any clothes worn by them had better be burned and their scanty wants in this direction renewed by the employers. All instruments used must be washed in carbolic lotion (1 in 40) and boiled before being restored to their cases. And here I may remark that all instruments employed in any *post mortem*, whether anthrax or anything else, must be kept locked up, and on no account be made use of in any surgical case, as, for instance, opening an abscess. Care must be taken not to scatter organs or blood about the place, but to restrict the infected area to the smallest limits. A pit should be prepared alongside and the carcass tumbled in. The soiled area should be well sprinkled with carbolic powder or other strong disinfectant, the ground dug up and thrown into the pit, a layer of straw should then be spread all over the ground and fired.

Appearances of carcass.

The belly is usually greatly inflated, bloody discharge may be noticed from the natural openings, decomposition sets in rapidly swellings may be present beneath the skin.

The blood is of a dark, tarry, and fluid character, often staining the cavities of the heart and interior of the blood vessels a peculiar red tinge. Any of the organs or all, namely, liver, spleen, kidneys,

lungs, brain, may be found engorged with blood, and their substance softened, and the spleen especially is often found enormously enlarged. In one case it weighed $62\frac{1}{2}$ lbs. The cavities, that is, the abdomen, chest, heart-bag, and cranial, may contain blood-stained fluid, and the lining membranes have scattered over them purplish blood spots or blotches. The bowels may be thickened, their contents bloody, and the lining membrane scattered over with purplish blood spots or patches.

The tumours above referred to consist of a yellowish greengage jelly-like material, which may have a dark centre and may be found in other parts, notably in the mesentery, or membrane connecting the bowels to the spine, around the kidneys, furrows of the heart, about the throat and other places, and when present may be taken as very indicative of anthrax.

The following cases are recorded by Frost :—

“*Post mortem* on an elephant belonging to the Commissariat Department, Rangoon. Died at 4-30 P.M. on the 25th of June 1878, after an illness of two days.

“Body well nourished and muscles of healthy hue. On removing the right fore-limb, my attention was at once drawn to the peculiar jelly-like deposit found in cases of anthrax. This deposit existed to a considerable extent in the connective tissue of the chest, muscles, and between the shoulder-blade and the ribs. In parts the deposit was of a yellowish white and in others of a rosy hue.

“Before commencing my examination of the body, and when conversing with Colonel Hawkes, Executive Commissariat Officer, I was told that amongst other symptoms exhibited by the animal was a small tumour in the region of the left parotid gland. I had the body turned in order to examine the tumour. On removing the skin covering the enlargement, a true anthracoid tumour presented itself. The same jelly-like exudate occupied a space of about 8 inches by 6 inches.

“The blood in the veins was of a dark, tarry consistence and colour, and in almost all the veins a certain degree of coagulation had taken place. Only the normal quantity of fluid in the abdominal cavity. Peritoneum healthy, mesentery congested. Spleen of a dark colour with considerable bloody spots and blotches all over its surface. The same deposit alluded to before existed between the layer of membrane attaching it to the stomach. On removing the spleen from the body I found it weighed $37\frac{1}{2}$ lbs. On cutting into its structure, and on withdrawing the scalpel, the blade had adhering to it a thick layer of blood as dark as ink. The gland could easily be broken down by pressure of the finger.

“On the under surface of the stomach, close to the pyloric orifice, I found a patch of the size of a dinner plate consisting of the same kind of deposit as I noticed in the tumour. In the tissue under the loins I also found the same thing to exist. Above the penis another large tumour was found.

“Intestines and kidneys healthy. There was a slight deposit in the substance of a lung which, to a certain extent, blocked up the bronchial tubes. A large quantity of frothy mucus was found in the windpipe and large bronchi, yet there was no symptom of breathlessness noticed before death.

“On laying open the pericardium (bag of the heart) my attention was arrested by the large quantity of fluid which was contained in the sac. From a careful but rough calculation, I came to the conclusion that it contained from 35 to 40 ounces of serum, possessing more the colour of venous blood slightly diluted with water than true serum. The external surface of the heart presented a peculiar appearance. Intensely dark blood spots studded its surface—some of the size of a rupee, others the size of an eight-anna piece, and others still smaller; these were particularly numerous on the right auricle.

“The horizontal and vertical grooves of the heart were filled with peculiar jelly-like deposit. Large clots in right heart and pulmonary artery and none in left. Although it is a remarkable fact that in anthrax the blood is generally found in a fluid state, I did not find this to be the case in the present instance. There was no unpleasant odour from the body, although the *post mortem* did not take place until 15 hours after death.”

These are the leading *post mortem* appearances noticed by me.

Post mortem No. 2 on an elephant that died at 10 A.M., 29th of June 1878, after two days' illness. Body examined seven hours after death; in good condition. On each side of the penis, about the region of the scrotum in other animals, I found two large tumours of the true anthrax character. Further, with the exception of the intestinal mucous membrane I did not notice anything peculiar. The mucous membrane of the intestines was highly congested. The blood in the vessels was fluid. Spleen weighed 24 lbs., liver 61½. I saw this animal at 9-30 A.M. (while still alive) and examined the tumours. They were cold as ice, and on cutting into them no pain was exhibited by the animal, nor did any discharge take place subsequent to the incision being made. Once I saw the nature of the effusion, I had no doubt of the result, which was death soon after.

Elephant-pox.

This is a specific fever characterized by eruptions somewhat similar to small-pox in man, but there is no evidence to prove that it is communicated from man or *vice versa*. These eruptions begin as pimples, then become blebs or blisters, with clear fluid contents. Later the contents consist of matter. Finally they burst, leaving sores which tend to scab.

Prognosis.—Good, especially in adults.

Symptoms.—Fever, with its attendant signs as mentioned under that condition and the eruptions above alluded to. I have seen only one case, namely, at Pakòkku. This animal came in from the direction of Gangaw. He was reported sick immediately on arrival. The mahout stated that the elephant had been out of sorts for some days, when suddenly this 'heat' eruption appeared; also that the animal was weak and listless. The elephant was in good condition, but his forehead, trunk, mouth, chest and shoulders, and a few places on the rump were covered with an eruption which had then arrived at the pustular stage.

Treatment (preventive).—As laid down under anthrax, *i.e.*, segregation, &c.

Curative (general).—As laid down for fever.

Local.—Cleanliness, washing with weak disinfectants such as carbolic acid, or phenyle (1—60) and afterwards dressing with carbolized oil (*see* Appendix No. 121), camphorated oil 122. All soiled dressings must be treated as in cases of anthrax, namely, be burned.

Surra.

Definition.—A specific and continuous fever due to the presence in the blood of an infusorian. Surra is a Hindustani word meaning rotten.

Period of incubation in mules, &c., from one month to seventy days.

Prevalence.—"The distribution of this malady seems to be entirely influenced by the physical aspect of the country, being far more prevalent in those parts where floods and inundations occur than in the higher and drier portions"—(*Pease*). In many districts of this province notably the Upper Chindwin, Pakòkku, Mogòk, Katha, and Bhamo, this disease causes heavy losses amongst mules and ponies every year. It is most prevalent between June and November, although cases are to be met with at all times of the year.

Sources of infection.—(a) Grain contaminated by the excrement of rats, mice, and bandicoots. Lingard and others have demonstrated the presence of the infusorian in the blood of many of these creatures.

(b) Sedgy vegetation from recently inundated country; stagnant pools, swamps, also water from such localities.

(c) Certain flies may carry the disease from infected to healthy animals.

The infusorian.—When a drop of surra blood is examined under the microscope, if the parasites are present, there will be observed a very peculiar intermittent quivering of the blood, if the specimen be watched we may soon see one or more minute thread-like organisms with eel-like movements emerge from the mass and wriggle slowly or actively across the field, sometimes one or more may be seen pulling a blood cell across the field. The infusorian is not continuously present in the blood, being absent during the intermissions so that it is a good plan to examine the blood morning and evening for a few days in suspected cases.

Symptoms.—The disease “is characterized by an intermittent, remittent, and sometimes a relapsing type of fever which continues for varying periods from a few days to months according to the species and the constitutions of the animals attacked” (*Lingard*). The pulse during the paroxysm is generally fast and strong and during the intermissions is about normal, as the strength fails so the pulse becomes feeble and thready. The respiration is as a rule not much altered. The mucous membranes in the early stages are usually pale but later take on a yellowish muddy tinge, that of the eyes is frequently blotched with mulberry-coloured blood spots.

The bowels are generally constipated, at times covered with slime and towards the end of the disease there may be diarrhoea. The urine as the disease progresses becomes viscid and sometimes of a greenish colour. One very remarkable feature about surra is, that no matter how high the fever may be, the appetite is invariably good, often voracious, throughout the course of the disease, but in spite of this fact there is a rapid and progressive loss of condition and great weakness. The blood undergoes profound changes, thus directly interfering with the proper nutrition of the tissues. There is marked debility and prostration and, as the disease advances, we often meet with dropsical swellings of the limbs and lower parts of the chest and abdomen.

Duration of disease.—The disease is divided into paroxysms and intermissions, the periods of intermission are short, being of two or three days' duration or less. The paroxysms last from two to

twenty-one days, death occurs sometimes after the first paroxysm, but it may be delayed until the seventh or even later.

Diagnosis.—If an elephant be found showing symptoms such as described, surra may be suspected; positive diagnosis, however, depends on the demonstration under the microscope of the infusorian in the blood. The parasites when present are not difficult to detect under an ordinary high power.

Prognosis.—In equines, invariably fatal. Dr. Lingard, who has been working at this disease for some years, succeeded in curing one or two cases after a very prolonged course of treatment. Though cattle are subject to surra they nearly always after considerable loss of flesh recover from the disease.

Treatment.—Arsenic is the only drug that has proved of service in this malady. Commence treatment by giving two grains twice daily, the quantity of arsenic should be increased by half a grain every second or third day till 10 grains per diem is reached, when the dose may be decreased daily by half a grain until two grains is reached. If the patient shows intolerance of the drug manifested by loss of appetite, weeping from the eyes, partial loss of power in hind-quarters, evidenced by unsteady gait, nervousness, the medicine must be discontinued. Liquor arsenicalis is the most convenient preparation, each ounce contains *four* grains of arsenic and as it is tasteless it is easily administered in sweetened gruel. The medicine should be given *after* the wards dressing wome food.

Prevention.—When grain is allowed it should be fully cleaned and inspected, an ample allowance of salt daily is necessary to maintain animals in health. Where possible elephants should be grazed on high ground and their water supply should of course be from a pure source.

In unhealthy places a short course of arsenic at the beginning of the rains may be tried.

Post-mortem.—Body generally much emaciated, on opening the abdomen a considerable quantity of straw coloured fluid may be observed. The internal organs are pale in colour, *i.e.*, more or less bloodless. The liver, also spleen, is sometimes enlarged, dark (claret coloured) spots or patches are often present on surface of the latter organ. The kidneys are often enlarged, congested and blotched with dark coloured spots. In mules and ponies in Burma we frequently notice that the mucous membrane of the stomach is ulcerated and stained a peculiar yellow, in fact there may be a general tinge of yellow all over the membrane owing to the escape of colouring matter of the bile. In the chest we find the heart pale, often flabby, and there is usually a quantity of straw-coloured

jelly-like material about the base, and beneath the lining membrane blotches and dark coloured spots may be seen. They are also to be seen beneath the internal lining membrane of the heart.

Note.—Surra has been described at some length as further information on this disease is solicited. I have received a few reports about cases of surra in elephants, and have seen cases of “Zahirbad” “Thut” which looked very suspicious; unfortunately I had not a microscope with me to make a satisfactory diagnosis. As much light can be thrown on the subject, I appeal to those gentlemen in charge of large numbers of elephants in the districts to keep a sharp look out on all cases of debility. Careful daily observation of the temperature will prove of great assistance in suspicious cases and I shall be pleased to receive early information of any outbreaks of intermittent or remittent fever amongst elephants.

Thut (ထုတ်).—It is desirable to mention here a so-called disease well-known by name to all elephant owners in Burma, namely, *thut*. I have noted that about half the deaths amongst elephants are attributed to snake-bite (*see* Poisoned wounds, page 167) and I think I may state without fear of contradiction the remaining half to the above-named malady. I have made many enquiries on the subject and have seen many cases amongst elephants and other animals and the conclusion I have come to is, that *thut* is a term applied especially to dropsical swellings under the abdomen and chest. These swellings are generally met with as a symptom in cases of surra, advanced debility, heart, kidney diseases, &c. In cases of surra, bilious fever, &c., amongst mules, ponies, as long as there are no swellings the Burmans diagnose the cases as fever, but once the limbs begin to fill and swellings appear about the belly the case is at once diagnosed as ‘*thut*.’ It is therefore merely a symptom which may develop during the course of many severe ailments.

Foot-and-mouth disease.

This is a specific contagious fever, accompanied by an eruption of vesicles (blebs or blisters) in the mouth, lining membrane of the trunk, and on the feet. At times only the mouth and trunk are affected, at others only the feet, but generally speaking all are involved.

Causes.—Contagion, usually from cattle suffering from the malady.

Prognosis.—Good, except in very young animals.

Symptoms.—The first symptom that generally attracts attention is, that the animal according to the soreness of the mouth, and degree of fever present is partially or wholly “off feed” or may be found limping. The disease is ushered in by fever with its attendant signs as already noted under that condition. This, however, often passes unobserved. If the mouth be carefully examined, there will be seen blebs or blisters (technically known as vesicles), sometimes the size of a broad bean which burst in from twenty-four hours, to a couple of days, leaving ugly red sores. The tongue, gums, palate, and cheeks may all be affected. The mucous membrane lining the trunk is also involved. Steel points out that in some instances “the eruption invades the mucous membrane of the alimentary canal, giving rise to exhausting diarrhoea and death.” This occurs chiefly in young animals. When the feet are attacked lameness is manifested, and, if examined, the parts above the nails, around the margin of the hoof slipper, will be found swollen, hot and painful. A discharge may be apparent; if not, pressure on the parts will probably reveal some oozing. The great danger here is, that the purulent matter may burrow, underrun the sole, and thus lead to casting of the slipper. Steel remarks that “when this casualty occurs, the case is not to be given up as hopeless, for so simple is this horny investment of the lower part of the limb that it can be well reproduced in the course of time.” Owing to the great weight to be sustained, severe pain and fever may be present in these cases.

Diagnosis.—This is distinguished from elephant-pox by the seat and nature of the eruption.

Treatment.—Foot-and-mouth disease being highly contagious, must be treated exactly as already laid down under anthrax. In simple cases, a little careful nursing, attention to cleanliness and diet, will be all that is necessary. The bowels should be kept regular by administration of mild laxatives (*see* Appendix 23 to 28). The mouth should be washed out three or four times a day with tepid water containing a little Condy’s fluid ($\frac{1}{2}$ ounce to a pint), or alum wash 1 to 2 drachms to a pint of water (a little treacle may be added). *See* also Nos. 109, 110, 113, 117 to 119. A tub of fresh water should be kept at standing.

Diet.—The diet owing to the soreness of the mouth, must consist of soft green grass, and as much freshly made gruel, linseed, tea, arrow-root, rice, as the patient will take. Fever must be treated as already laid down under that heading.

When the feet are involved, the affected parts, if tender and painful, should be fomented, or washed with carbolic lotion (1—60), or corrosive sublimate (1—1,000) (*see* Appendix 116) carefully remov-

ing any dirt. The parts should then be dressed with camphorated oil No. 122, carbolic oil No. 121, or ointment of eucalyptus No. 128, covered with tow, and a piece of clean cloth tied round the foot, which should then be enveloped in a clean gunny-bag which has previously been dipped in some disinfecting solution and the same precautions observed with regard to soiled dressings as laid down in anthrax. In severe cases a leather boot must be applied. Every care must be taken to see that the affected parts are protected from flies and dirt. No specific remedy is known.

Blood-poisoning.

(1) Septicæmia is met with in two forms:—

(a) Septic poisoning.

(b) Septic infection.

(a) *Septic poisoning*.—The effects produced by the absorption of a poisonous dose of the chemical products of germs without the germs being alive that elaborate these poisons. In this the symptoms must be directly in proportion to the dose absorbed, which dose cannot increase in the body.

(b) *Septic infection*.—The effects produced by the absorption of living infective germs. The symptoms here are not proportionate to the initial dose which may be infinitesimal and not lethal, but which owing to multiplication of the germs in the blood and a corresponding increase of poison elaborated by their vital processes leads to death, sooner or later.

This naturally is of a graver character than the preceding.

(2) *Pyæmia*—Occurs in the same way as septic infection, but differs in its symptoms.

Prognosis.—In septic poisoning if the dose is small recovery probable. In septic infection and pyæmia recovery rare.

Causes.—Always due to absorption through some abraded surface, *i.e.*, sores, scratches, heel cracks, abscesses. The poison may have been introduced by the weapon causing the injury or may have been absorbed subsequently from neglecting the wounds (a frequent cause).

Symptoms.—In all forms the following are the most frequent, repeated shivering often unnoticed, and sudden accessions of high fever, often followed by a fall of temperature sometimes to normal before the next rise, grave prostration, and muscular tremors being marked symptoms, and towards the end foetid diarrhœa; occasionally there may be paralysis of the hind-quarters. The disease takes a rapid course, ending usually in death after a short period.

In septic poisoning no further symptoms are observed, but in septic infection there may be swelling of joints and collections of fluid in the body cavities (chest, belly), and in pyœmia abscesses scattered over the body and in the organs. In septic poisoning death occurs more rapidly than in the other two forms.

(a) *Treatment: Preventive*—is the most important and consists in strict attention to all kinds of wounds, however trivial, which if properly treated should almost preclude chances of infection.

(b) *Curative*.—First thing necessary is local treatment, which consists in thoroughly cleansing with disinfectants, the wound or wounds, and when abscesses occur, freely opening them, and syringing the cavities out with some disinfecting solution (Carbolic acid lotion 1—40) and *see* Nos. 114 to 120 and afterwards dressing. Soiled dressings should be treated as already noted under anthrax.

With regard to general treatment no certain remedy is known, but the following may prove useful. The diet must be nourishing, such as fresh green grass, fruits, wheaten cakes, gruels, and, though fever is present as an exception, rice or other grains should be offered, also stimulants.

Hyposulphite of soda, or sulphite of soda in 2 ounce doses every three hours, or small doses of calomel, say, $\frac{1}{2}$ drachm repeated every three or four hours.

Rabies.

Rabies is a specific disease caused by the introduction into the system of a specific poison, through the bite of an animal, generally that of a dog; but jackals, wolves, may also communicate it. It is a rare affection amongst elephants. The following case was communicated to Dr. Gilchrist by a mahout personally acquainted with the facts: "A mad dog, about five years ago, appeared in the elephant lines at Hyderabad. It attempted to bite several elephants, but was by each driven away. During the night it attacked an elephant when asleep and bit it on the trunk. The bite marks having been distinctly observed next day, a little oil was applied, but nothing more was done and nothing particular occurred till a month after the infliction of the bite, when decided symptoms of delirium, as described under the head 'Ahren Bhao,' suddenly supervened. During the first three days the animal took fodder, ratib, and water, but afterwards took nothing. It did not appear to be afraid of water, as it drew it into its trunk and squirted it about, but did not drink any. It continued furious for two days, not allowing even the mahout to approach, after which it fell down and died suddenly. On the same occasion another elephant

“died fifteen days after the one above alluded to, with the same symptoms, but it was not clearly known whether the animal had been bitten by the dog, though it was one of those it attempted to bite. The above cases occurred about the month of October. A man and bullock had been bitten by the same dog, and both died “mad.”

An account of a case is also contributed to the *Oriental Sporting Magazine*, by Captain F. H. Hood, B.S.C., Volume III.

Treatment.—Should an elephant chance to be bitten by a dog, the wound should be thoroughly cauterized without delay with pure carbolic acid and dressed with carbolic lotion 1 in 40, or a very strong solution of lunar caustic, or the wound may be cauterized with a hot iron. Liquid caustics are preferable to solid (Appendix 57 to 60). Soiled dressings should be treated as mentioned under anthrax.

The elephant should be well secured and kept under constant observation.

The early symptoms are excessive trembling and convulsive twitchings; later on inability to swallow. On the manifestation of any extraordinary behaviour, extra shackles should be applied and the animal destroyed without delay.

Tetanus or lock-jaw.

Definition.—An infective disease due to the entrance into the blood of a poison generated by a germ, the tetanus bacillus. This disease is as far as I am aware rare in these creatures.

Incubation.—Varies from a few hours to several days.

Prognosis.—Unfavourable; frequently fatal.

Causes.—Absorption of the germ through an abraded surface, wound, sores, and particularly punctured wounds about the feet. This germ remains local and does not enter the blood.

Symptoms.—Dulness, stiffness of the muscles about the jaws, stiffness in movement, sunken eyeballs, timidity, sensitiveness to sounds, with repeated attacks of violent spasms of the muscles of the body and often irregular fever, and the most characteristic symptom after spasms is the partial or complete locked condition of the jaw.

Treatment: Preventive: Segregation.—Though it is a less contagious disease, infection has been known to attach itself to certain stables, for years.

Curative: (a) Local.—Careful inspection for abrasions, sores, and, if found, careful cleansing with carbolic lotion (1 to 40),

cauterization with pure carbolic acid, and careful dressing. Search should be made for thorns, splinters, and, if found, removed, and wounds treated as above.

(b) *General*.—Isolate, preferably in a quiet, dark, shady place. Quietude as perfect as can be arranged for is one of the most essential points in furthering a favourable issue. Clean water, freshly made gruel and some tempting fresh fodder should be placed within easy reach. When possible a brisk purgative should be given by the mouth; if not possible by this means, remove the dung from the rectum and give an enema, a pint of castor-oil with 15 to 20 drops of croton oil (Appendix Nos. 77 to 80). Powdered henbane leaves or seeds in 2-drachm doses may prove beneficial. Take of extract of belladonna 4 drachms and glycerine 1 ounce, water 2 drachms and rub the mixture into the muscles of jaws. Unnecessary interference in these cases is to be deprecated.

All dressings when removed must be placed in a proper receptacle (never on the ground or floor) and subsequently burnt under supervision and the receptacle cleansed with carbolic solution (1 in 40).

Epidemic pneumonia.

This is based on the description of an epidemic in 1839 on coast of Tenasserim and recorded by Dr. MacDonald.

Many elephants were attacked simultaneously, and at that time bullocks were suffering from apparently the same disease. The mortality was very high; no symptoms are recorded, but on *post mortem* usually one lung was found extensively diseased, the other *pretty* healthy, which leads one to infer that it was *not* quite healthy. The diseased portions of lung were engorged and in colour varied from florid red to black. Referring to the works I have had access to, it is significant that no other author has seen a similar outbreak. The *post mortem* appearances recorded are more or less compatible with cases of pulmonary anthrax.

Rheumatism.

Rheumatism is a painful and not uncommon ailment, usually affecting joints and other parts of the body and may prove very troublesome owing to its liability to recur. Moreover, recovery is often tardy.

Causes.—Chiefly due to exposure to cold and wet, more especially when an animal is heated, such as after hard work or a

march, by being taken into cold water for bathing, or being allowed to stand without protection, insufficient shelter, removing guddela, &c., before the body has had time to cool, working in and out of streams for hours together. It is naturally more prevalent at high elevations and during the rainy season. By exposure I wish to imply that elephants for want of a little forethought are subjected to constant conditions without any reference to changes of weather and temperature; for instance, when it is raining with a very cold wind blowing it may be difficult to protect him from rain, but removal to a distance of 50 yards might give ample shelter from the wind, yet no one thinks of it. The animal remains tethered and even after the storm cannot free himself to revive his vitality and warmth.

Prognosis.—Variable. Some cases tend to get quite well, others to frequent recurrence and thus become a nuisance to their employers.

Diagnosis.—It may be distinguished from sprain owing to the shifting nature of the seat of pain; one day a fore limb may be affected and a day or so after it may be better, or quite sound, but another member may be affected. In the case of a sprain, lameness does not wear off with exercise, but is probably aggravated by it, and is constant in the limb originally affected.

Symptoms.—There is little or no fever, and it generally attracts attention owing to considerable stiffness or lameness. The animal is usually able to walk about and, though very stiff or lame at first, this wears off with a little exercise, the affected joints are tender, painful, and swollen, the appetite is unimpaired.

The joints most frequently attacked are the knees, hocks, and the joints about middle of fore and hind leg.

Treatment: Preventive.—Must be directed to removal of the causes enumerated above.

Curative: Local.—Rest and hot fomentations frequently applied to affected parts rubbing in with friction liniments (see Appendix Nos. 70 to 76). Hayes recommends the following handy liniment,—Kerosine oil in which as much camphor as it will take up has been dissolved.

General.—Bowels to be kept regular by administration of laxatives (see Appendix 23 to 28). Bicarbonate of soda or potash, $\frac{1}{2}$ an ounce once or twice a day for two or three days often does much good, also course of arsenic.

Change to a dry climate is most beneficial, and which at times can be managed.

CHAPTER VI.

THE HEART—PULSE—BLOOD-LETTING OR BLEEDING.

Heart.

THE heart is a hollow muscular organ consisting of four chambers, situated within the chest and enclosed within a bag (the pericardium).

The two upper chambers are called auricles, the lower two, ventricles.

The circulation of the blood is carried on by means of the heart, arteries, capillaries, and veins.

(a) The heart beats from 46 to 50 times a minute.

(b) The arteries are the channels which convey blood from the heart, distributing it over the system. If an artery be pressed by the finger, an impulse or shock is felt, known as the pulse.

(c) Capillaries are the very minute channels which allow certain portions of the blood to pass through their walls into the surrounding tissues for their nourishment.

(d) Veins are the channels which carry blood back to the heart.

The veins unite and reunite, finally carrying the venous blood to the right auricle, from which it passes into the right ventricle, and from thence through the artery of the lungs (pulmonary, the opening of which is in the ventricle) to those organs, where after oxygenation it is carried to the left auricle, then to the left ventricle into the aorta, a large artery which distributes the purified blood over the body.

The orifices between the auricles and ventricles are guarded by valves, as also is the entrance to the pulmonary artery and aorta. What happens is roughly as follows: The blood pours into the right and left auricles, which when full contract, thus driving the blood into the ventricles, which on filling the valves shut off their communication with the auricles; the ventricles now contract driving the blood on the right side through the pulmonary artery to the lungs for purification, and through the aorta on the left side for distribution of the blood over the system; the valves close when the vessels are filled, preventing a reflux into the ventricles.

Pulse.

“The impulse or shock caused by the overfilling of the aorta during the ventricular systole (contraction of ventricles) is the cause of the pulse”—(*Ashby*).

In a healthy elephant when at rest, if the finger be applied to an artery, the vessel will be found to expand between 46 and 50 times a minute; a short increase or decrease may be quite normal.

Many things increase the frequency of the pulse rate—exercise, fever, fear, age. In young animals it is faster than in aged beasts.

The pulse is a useful indication as to the state of the circulation; the character also has to be noted, as it varies; for instance in debility we often get a soft and frequent pulse; in some heart affections an intermittent pulse, that is, there is an occasional interval between the beats.

The most eligible place for taking the pulse is at the back and root of the ears, where will be distinctly seen a branch of an artery running over the cartilaginous root of the ear and subsequently ramifying on its surface. The pulsation will readily be felt by applying the finger. It is not, however, so easy a matter to determinate the exact number of pulsations, as the animal approached by a stranger, and especially in the recumbent position, in which it requires to be placed for the purpose, will not easily remain sufficiently quiet for the required time. The better way is to cause an intelligent mahout to count aloud the pulsations while the animal is standing and when the circulatory system is not disturbed by fear or exertion on the part of the animal. In every establishment one or two mahouts may be taught to take the pulse accurately. It may be assumed that this organ (the heart) becomes diseased in the elephant as it does in other animals, but possibly not nearly to the same extent. Whatever conditions may exist are at present shrouded in obscurity for obvious causes—lack of specially trained men and the difficulty in dealing with these creatures.

The *symptoms* which might point to this organ being diseased are alterations in the character of the pulse, intermittent, &c., breathlessness as soon as put to work, or exhaustion and fainting shortly after, the presence of dropsical swellings such as have been mentioned under debility, and conditions pointing to a weak circulation such as ulceration of the ears and tail and finally sudden death unattributable to no other cause.

Treatment consists in absolute rest and bettering the condition of the animal by means of liberal diet and stimulants, such as whisky, rum.

Other conditions have been mentioned *post mortem*, namely, atrophy (wasting of the substance) of the heart, hypertrophy or enlarged heart, and rupture from extreme and sudden exertion.

Blood-letting.

This consists in the abstraction of blood from the system locally or generally. I cannot recommend it in elephants.

The objects are—

- (a) to reduce the action of the heart and so the force of the circulation;
- (b) to reduce the quantity of blood in the system.

Dangers of blood-letting.—Failure of the heart and collapse, anæmia from excessive loss of blood. Blood when abstracted is taken from the vessel behind the ear in cases such as apoplexy, heat-stroke, or from the large vein on the inside of the thigh. The animal having been carefully fettered, the part is washed and a string is tightly tied round the limb above where it is intended to open the vessel; this raises the vein. An incision must be made through the skin and the vein opened. Elephants cannot afford to stand a large abstraction of blood; the state of the animal and condition of the pulse should denote when enough has been taken.

CHAPTER VII.

THE NERVOUS SYSTEM—INFLAMMATION OF THE LINING MEMBRANE OF THE CAVITIES IN THE BONES OF THE SKULL—CONGESTION OF THE BRAIN AND ITS MEMBRANES—APOPLEXY OF THE BRAIN—PARAPLEGIA—REFLEX PARALYSIS—PARALYSIS OF THE TRUNK—PARALYSIS OF THE FLAP OF THE EARS—SUNSTROKE—HEAT EXHAUSTION—HEAT APOPLEXY OR HEAT STROKE.

The Nervous system.

THE nervous system consists of (*a*) the brain, (*b*) the spinal cord, (*c*) the nerves.—

- (*a*) The brain is contained within the cranial cavity. It is the organ that regulates every vital process in the body, it is the seat of the will and intelligence, it controls all motion, appreciates and locates sensation, and its activity is exhibited in part by what is termed consciousness.
- (*b*) The spinal cord is contained within the vertebral canal, and is in relation to the brain what a local post office is to the general post office. It only controls certain functions of the body and even in those is itself controlled by the brain.
- (*c*) The nerves are merely conducting media between sensitive surfaces or organs and the brain and cord. They are the telegraph wires which convey the messages emanating from the brain, spinal cord, or special organs of sense, the outcome of which may be seen in a variety of ways, such as size of the pupil, degree of redness of mucous membranes, the activity in the secretion of a gland, the movement of a muscle or a limb, the voiding of excreta, &c.

Inflammation of the lining membrane of the cavities in the bones of the skull.

Causes.—Prolonged exposure to the sun, injuries to the forehead and bullet wounds. Steel remarks that it may be due to the extension of inflammation in consequence of the intimate vascular connection through the bones between the skin on the forehead and this lining membrane. Gilchrist gives as causes the exhibition of

stimulating mussels to elephants who work much in the sun, and to sudden cooling of the body by taking a heated animal into water.

Symptoms.—These are not very evident, but the history of the case will assist. The skin on the forehead may become sore and ulcerated and later the bone may become diseased; there may be considerable excitement and delirium.

Treatment.—Keep in a cool quiet place. Fetter carefully, give a dose of physic. If the head be injured, fomentations may be applied; the wounds to be kept clean and dressed regularly; should matter form, it must be given exit. In the cases resulting from exposure to the sun, cold cloths frequently applied may afford much relief. Cooling medicines such as tamarind pulp, epsom salts, may be given with advantage. Green food should be given in moderate quantities.

Congestion of the Brain and its membranes.

The brain and the membranes covering it are intimately connected, and it is a difficult matter to distinguish between congestion of either separately; hence it is best to consider them together.

Causes.—The more common causes of congestion are prolonged exposure in the sun, extension of inflammation from the membranes lining the air cavities in the bones of the head, acute indigestion, the result of high feeding, insufficient exercise, and frequent use of stimulating mussels which the attendants are so fond of giving.

Symptoms.—Fever with its attendant signs noted under that condition. The animal appears giddy, may stagger in his walk. In the later stages other symptoms may become pronounced, notably excitement. The condition may run on to inflammation.

Treatment.—Owing to the violence and danger of approaching animals in this state, treatment is dangerous; if it can be managed, a smart dose of physic, such as croton oil, should be administered. When possible, constant application of crushed ice, or cold water to the head, is most beneficial.

Plenty of gruel or fresh water should be kept near the standing, to which a little nitre (4 to 6 drachms) may be added.

Apoplexy of the Brain.

A condition characterized by a sudden loss of motion and consciousness.

Causes.—Rupture of a blood-vessel of the brain, resulting in the escape of blood upon or within that organ. In old animals de-

generation of the blood vessels may predispose to rupture, which may be actually brought about by violent or prolonged exertion. Apoplexy may occur during a severe attack of congestion of the brain.

Symptoms.—There may be no symptoms; the animal suddenly drops and becomes comatose.

Death results from the effects of pressure on the brain from the initial quantity of escaped blood, or from a fresh hæmorrhage. Some cases recover, but it is a slow process and not infrequently some form of paralysis develops.

Treatment.—Cold to the head; bleeding (*see* page 114). Should the animal recover, care must be taken not to expose him. Stimulating mussauls or stimulants should on no account be given.

Paraplegia.

Paralysis of the posterior portion of the body, though common enough amongst mules and ponies under the name of "*kumree*," "windstroke," "gone in the loins," is distinctly rare among elephants. It is met with, however, in some cases of anthrax, and as a result of a bad chill.

Causes.—Altered conditions of the blood as in anthrax and kindred fevers, cold, and wet, injuries to the spine by falls.

Symptoms.—A difficulty of movement, swaying and dragging of the hind-quarters, and loss of power in them. The animal may even fall.

Treatment.—Give a smart dose of physic; fomentations to the loins, to which extract belladonna or ganja may be added, should be applied. Blistering the loins (*see* Appendices 54 to 56). Belladonna internally one drachm twice a day, and later tonics, such as nuxvomica and iron, arsenic (*see* Appendix 39 to 46). Iodide of potassium, two drachms twice a day, may in time bring about complete recovery.

Reflex Paralysis.

Is a similar condition to the last, but brought about by causes not affecting the spine directly, but indirectly through nerves connecting it with remote parts. Severe constipation, worms, and indigestion may produce this condition, which is usually trifling and amenable to treatment directed to the removal of its cause. Should the condition not be better in a week or so, advantage may be derived from the application of a blister to the loins and its subsequent repetition if necessary.

Paralysis of the trunk.

Loss of power in this important organ must necessarily lead to starvation, unless special means are taken to ensure the affected animal being hand-fed, and also that he be taken to water deep enough to enable him to drink with his mouth.

Causes.—Paralysis may be met with in cases of advanced debility, or come on as a complication of sunstroke, or apoplexy. It is clear that the most humane way of dealing with such a case is to destroy the animal.

Treatment.—If it is decided to treat the case, it will be necessary to see that the animal receives ample nourishment and tonics, such as nux-vomica, arsenic, sulphate of iron (Appendix Nos. 39 to 46).

Paralysis of the flap of the ears.

Causes.—Seen in some cases of advanced debility.

Symptoms.—The ears droop downwards and forwards and are immobile.

Treatment.—As in the last.

Sunstroke.

This term is applied to a condition usually brought about by exposure to great heat and glare.

Sunstroke in the elephant may be divided as follows:—

(a) heat exhaustion, and (b) heat stroke, or heat apoplexy.

Heat exhaustion.

Causes.—Cases of heat exhaustion are of very frequent occurrence, the usual cause being over-exertion in great heat. These creatures, by nature nocturnal in their habits, stand prolonged exposure to the sun very badly. The condition generally occurs in animals that are well fed, but irregularly worked, and then suddenly called on to do a long march in the heat of the day, and in weakly animals when subjected to long exposure, or in those that are of a nervous, or excitable temperament. The digestive system, when out of order, also tends to increase the susceptibility.

Symptoms.—The symptoms usually come on towards the close of a trying hot march. There is evident distress and dullness; the

animal is fatigued, slows down in his pace ; the breathing is hurried, and the ears droop ; the trunk is lax, and not swung about freely ; if these symptoms escape notice, the prostration increases until the animal more or less suddenly falls down in a faint. The temperature may be subnormal. These cases are met with most frequently when the atmosphere is moist, oppressive, and still.

Treatment.—Immediately remove the load, gear. Dash cold water if possible from a height for some time over the head, neck, chest, and along the spine ; if lying in the sun, run up a single or double tarpaulin as an awning to afford shade, but not so as to impede free circulation of air ; for the same reason, men should not be allowed to crowd around. Wash the face, head, and trunk with cold water, and sponge out the mouth and lips with weak vinegar and water, or plain water. The head and face should be fanned if there is no breeze ; a weak solution of ammonia if any be handy poured on to a wet cloth, which may be thrown or placed on a bamboo near orifices of the trunk may prove beneficial. As a rule after a little time the animal pulls round and will drink some water if presented ; when he gets up he should be removed to the nearest shade. An aperient may be given with advantage. Clean fresh grass in moderation should be allowed ; it is better to reduce the ration for a day or so. Whenever possible, arrangements should be made for the load and gear to be taken into camp. After a rest of from thirty-six to forty-eight hours, he may during the cool hours of the morning or late evening be quietly taken to camp. Great care, however, must be taken to avoid subjecting the elephant to exposure to sun for a considerable time afterwards.

Death may occur from failure of the action of the heart.

Heat apoplexy, or heat stroke.

The symptoms are similar to those met with in heat exhaustion, but the animal may be somewhat excited ; he staggers about, trembles all over, breathes very hurriedly, and finally falls down in a more or less unconscious state. In some cases there may be symptoms of delirium ending in convulsions, or coma and death. The temperature usually ranges high.

Causes.—Heat apoplexy may occur either while an elephant is idle, or at work. In many cases the animal, if examined beforehand, would probably have been found feverish and out of sorts ; if worked in this condition, the temperature may rise to such an extent as to bring about a stroke.

Treatment : Preventive.—Do not permit elephants to be worked in the sun during the day in the hot weather, *i.e.*, between the hours

of 10 and half past 3. If work has to be performed during these hours, the head should be protected by a quilted cotton pad. Frequent rests are desirable and the animals permitted to take water in small quantities occasionally. It may even be advisable, on a long march, to halt the animals half way, and relieve them of their loads, allowing a rest for three-quarters of an hour. Before being sent on the march, or put to work, it is a good plan to have every animal carefully inspected; any showing symptoms of fatigue, or ill health, should on no account be sent out. On the march some person ought to be held responsible to look after the elephants while travelling; should any show signs of distress, evidenced by slowing down, staggering in their gait, or trembling, they should be halted (in the shade, if possible) without delay, the load and gear quickly removed, and cold water dashed over the head and spine; even if relieved by these means, they should not be permitted to proceed on the journey till the evening or early next morning.

Remember that one attack predisposes the animal to another; therefore every care ought to be taken to avoid causes calculated to induce a recurrence.

Curative.—As in exhaustion, crushed ice if procurable should be applied to the head and spine, if not continuous cold water applications. The state of the temperature of the body ought to be noted at intervals. The patient may recover, but restoration to health is very slow, and not infrequently paralysis in some form may develop. Tonics are useful during convalescence.

Death may result in a few hours from failure of the action of the heart, suffocation, or from exhaustion following on the intense heat and consequent failure of the vital powers of the body.

CHAPTER VIII.

THE RESPIRATORY ORGANS—CATARRH—MUMPS—PNEUMONIA—BRONCHITIS.

The Respiratory Organs.

THE respiratory tract consists of—

- | | |
|----------------------------------|----------------|
| (a) Nostrils. | (c) Wind-pipe. |
| (b) Nasal chambers in the skull. | (d) Lungs. |

The lungs are the organs which furnish the blood cells with oxygen, which, being circulated by means of the heart, distribute oxygen to the tissues which build up the system. Oxygen is necessary to the life of those tissues. To effect this charging of the blood cells with oxygen, breathing is constantly going on, and consists of two acts, the first during which air is conveyed through the respiratory passages to the lungs to purify the blood (inspiratory act), and the second during which air with impure products generated in the system is thrown out (expiratory act). During inspiration the chest expands and on expiration it contracts. In health this double act is performed on an average 13 to 16 times a minute.

The mucous membrane at the orifices of the trunk is a rich pink colour and moist, with an occasional drip of clear fluid. Any departure from those conditions may indicate disease of this tract and may be summed up as follows :—

- (a) Undue redness of mucous membrane of trunk.
- (b) Constant dripping of a clear or opaque yellowish fluid from trunk.
- (c) Soreness inside the trunk.
- (d) Cough.
- (e) Hurried or difficult breathing.
- (f) Impaired movements of chest with compensatory increase of movement of belly during breathing.

Catarrh or Cold.

Causes.—Chill, exposure to winds, cold, wet.

Symptoms.—Fever and attendant signs described under that condition. Constant discharge of watery or opaque fluid from the

trunk and watering from the eyes, the eyelids often swollen and half closed. The causes which produced the condition in this tract often affects other parts ; hence diarrhœa may be present.

Treatment: Preventive.—As laid down under rheumatism, page 110, and *curative* as laid down under fever, except that enemas should be given instead of purgatives, supplemented by the following :—

Camphor	...	...	...	2	drachms
Liquorice	...	...	...	†	ounce

twice a day, or

Sweet spirits of nitre	...	...	...	2	ounces
Liq. ammonia acetatis dilute	...	...	...	4	ounces

twice or thrice a day.

Mumps or Sore-throat.

Causes.—Sudden chills and exposure to cold winds when heated.

Symptoms.—Fever with its attendant signs, swelling about the throat and adjacent glands (parotids), difficulty in breathing and swallowing. In extreme cases the throat may be so involved that the animal may suffocate. Gilchrist states that in some cases food becomes impacted in the gullet, causing mortification.

Treatment, General.—Only allow gruels, linseed tea, boiled rice while there is any difficulty in swallowing ; protect the animal from the weather ; if he will take it, allow nitrate of potash in half ounce doses in the drinking water. The following will be found useful :—

Extract of belladonna	} of each 4 drachms.
Powdered camphor	...	...
Powdered chlorate of potash	...	...
Powdered nitrate of potash		1 ounce.	
Powdered liquorice		4 ounces.	

To be mixed and well rubbed down with a few ounces of honey and jaggery. It should be made into a thin paste. A little of this should be taken and rubbed in the mouth every half hour or so.

Local.—Enemas to relieve the bowels, frequent hot fomentations to the throat, and mustard or other embrocation (Appendix 70 to 73) rubbed in. Steel recommends steaming through the mouth with infusions of *nim* leaves (○○○○ꝓꝓ, *ta-ma-ywet*).

Pneumonia.

Inflammation of the lungs.—By pneumonia is meant inflammation of the tissue or substance of the lung.

Causes.—Chill from exposures to cold winds and wet.

Prognosis.—Favourable.

Symptoms.—Fever as described under that heading, out it usually lasts only a few days, and, if death does not ensue speedily the animal begins to mend and a favourable result may be expected. The patient does not as a rule lie down during the early part of the attack. The breathing is hurried and the chest is found to move little or not at all during respiration, but the belly moves unusually during this act; cough, yawning, are frequent symptoms.

With careful nursing and treatment the diseased organ usually regains its health and function, but at times the inflammation may be so severe that the diseased portion of lung mortifies and the animal almost always dies. This untoward event is characterized by a sudden subsidence of urgent symptoms, increased rapidity and weakness of pulse, great prostration and fœtid breath. Sometimes the diseased lung ends in forming an abscess, which may be suspected by an undue continuance of the fever, accompanied by marked dullness.

Treatment, local.—Frequent hot fomentations, after which embrocation should be applied (Appendix Nos. 70 to 76).

General.—A laxative (Appendix Nos. 23 to 28), stimulants, whisky, brandy (sweet spirits of nitre in 3 or 4 ounce doses), plenty of gruel. Tonics during convalescence (Appendix 39 to 46).

Bronchitis.

Definition.—Inflammation of the mucous membrane lining the air-tubes in the lung.

Causes.—As in pneumonia.

Symptoms.—If acute, fever with its attendant signs, cough, wheezing, and laboured breathing.

When chronic, symptoms are very similar, only fever is absent.

Treatment.—In the acute cases as laid down for fever, employing enemas in lieu of purgatives, supplemented with the following:—

Opium	...	..	...	...	1 drachm
Camphor					2 drachms
Squills (powder)	...	...			2 drachms
Liquorice (powder)		...			1 ounce

twice or thrice daily or—

Myrrh	...	...			3 drachms
Assafoetida	...	...			3 drachms
Aniseed	...	...			1 ounce

twice daily. Embrocation should be rubbed into the chest.

Bamboo leaves are very often given to animals suffering from cough.

CHAPTER IX.

THE URINARY SYSTEM—NEPHRITIS OR INFLAMMATION OF THE KIDNEYS—CYSTITIS OR INFLAMMATION OF THE BLADDER—RETENTION OF URINE—HÆMATURIA OR BLOODY URINE—DIABETES.

The Urinary System.

THIS consists of—

- | | | |
|--------------|--|--------------|
| (a) Kidneys. | \| | (c) Bladder. |
| Ureters. | \| | (d) Urethra. |

The kidneys (two in number) are situated in the loins, one on each side of the spine. Their function is to withdraw from the blood passing through them certain poisonous products which have been elaborated in the system.

These poisons pass in a state of solution called urine from the kidneys through two ducts called the ureters to the bladder, where after a certain quantity has collected the animal voids it through the urethra or passage through the penis.

The elephant passes water from about 10 to 14 times during the 24 hours. This fluid in health has the following characters,—Specific gravity 1,004; colour watery or faint amber, and towards the close of the act may be a little turbid; it is clear and has a peculiar characteristic smell, not disagreeable. Any deviation from the above should lead one to suspect disease of the urinary tract, namely,—

- (a) Increased frequency in making water.
- (b) Arrest of the flow (suppression).
- (c) Constant dribbling.
- (d) Offensive smell.
- (e) Alteration in colour. It is invariably high coloured in fever; may be greenish when the liver is affected, and markedly reddish when admixed with blood.
- (f) Pain, evinced by straining and groaning during the act of voiding; also by increased restlessness, denoted by frequent changes of posture, that is, constant shifting of feet, lying down and getting up.

Nephritis or Inflammation of the Kidneys.

The kidneys like other organs are apt to become inflamed.

Causes.—Chill from exposure to cold and wet, any of the acute fevers such as anthrax, certain drugs such as Spanish fly (cantharides) and turpentine.

Symptoms.—Fever, with its usual symptoms noted under that condition; usually increased frequency in voiding water, which act is often accompanied by pain, but the amount of water passed is frequently very small. Sometimes it is suppressed. The urine itself is very high coloured and may be mixed with blood.

Prognosis.—As the function of the kidneys already described is to remove poisonous matters from the blood it follows that when these organs are diseased these poisons are partially or wholly retained and in course of time will produce death; hence prognosis is unfavourable.

Treatment: (a) Local.—A mustard plaster one foot square on each loin for an hour (*see* Appendix, page 224) or hot fomentations to the loins, but turpentine must never be employed. A blister to the loins may be applied, but neither turpentine nor cantharides should be used. Biniodide of mercury (1 to 16) (Appendix—Blisters, No. 55) is perhaps the best agent to employ; the blister should be about a foot square. Soap and warm water enemas, to which may be added chloral hydrate $\frac{1}{2}$ an ounce, or extract of belladonna 1 to $2\frac{1}{2}$ drachms.

(b) General.—As laid down under fever, and a liberal allowance of linseed, rice, or wheaten gruels, supplemented by the following drugs,—Bicarbonate of potash in $\frac{1}{2}$ ounce doses two or three times a day, or the acetate of potash in 3 drachm doses two or three times a day.

Cystitis or Inflammation of the Bladder.

Causes.—Chill.

Symptoms.—Fever, with the symptoms already noted. Increased frequency in voiding urine, accompanied by straining; urine turbid.

Treatment: Local and General.—As laid down for inflammation of kidneys. The loins should be protected with a rug.

Retention of urine.

This is a condition characterized by inability to empty the bladder and may be complete or partial.

Causes.—It may be due to nervous disturbance after an accident, such as a heavy fall, especially when under a load, the retention being sudden and complete; or to over distension of the bladder, causing

paralysis of the muscles ; to debility of the walls ; and to the presence of growths interfering with the action of the muscle. Obstruction may also be a cause, such as from the presence of a stone, tumours pressing on the bladder and blocking the passage. It also appears as a common complication in paraplegia, excessive accumulation of fœces in the rectum, and colic. Partial retention owing to nervous excitement is sometimes met with in "*musth*."

Symptoms.—Pain, restlessness, frequent attempts to pass water, which after an unusual interval, during which no water is passed, dribbles away in drops, or a small feeble stream. If the arm is passed well into the rectum, the bladder may be felt distended (the bladder is situated immediately below the rectum).

Treatment: Local.—Frequent hot fomentations to the loins. Empty the rectum with the hand and throw up soap and warm water enemas, to which chloral hydrate $\frac{1}{2}$ an ounce may be added. Insert the arm and apply gentle pressure to the bladder if that organ can be felt distended.

General.—A brisk purgative, and afterwards linseed or rice gruel *ad lib*.

Hæmaturia or bloody urine.

Blood in the urine may arise from three sources, namely, (*a*) the urethra, (*b*) the bladder, (*c*) the kidneys.

If the passage of urine be preceded by the passage of a clot, or, if blood be passed involuntarily and independently of the act of staling, it is certain that the source of blood is from the urethra or passage. When the blood is not well mixed with the urine and clots are passed towards the close of the act of staling, we may assume that the blood is from the bladder.

If the blood be from the kidneys, it is intimately mixed with the urine, giving it a reddish, smoky tint.

It is not an easy matter, by ordinary inspection, to determine whether blood is from the bladder or kidneys.

Causes.—The common cause of discharge of blood from the urethra is an injury. Blood from the bladder may arise from acute inflammation, stone, ulceration, tumours, &c. In the case of the kidneys blood may arise as the result of injury, acute inflammation of the organs, stone, parasites, cancer. Blood may also follow on the excessive or indiscriminate use of drugs, notably cantharides or turpentine, or after feeding on certain acrid plants.

Treatment.—This depends of necessity on its cause, it being a symptom of several diseases. The bowels must be kept regular ; the patient allowed complete rest ; the diet should be nutritious and

moderate in amount. In order to control the bleeding if very excessive, good results may be expected by the exhibition of such drugs as gallic acid, acetate of lead, alum, and some preparations of iron.

	Acetate of lead	...	...	1 drachm
	Gallnuts (powdered)	...	...	2 drachms
	Jaggery	...	...	Sufficient
twice or thrice daily, or—				
	Tincture of perchloride of iron (dilute)			1 ounce doses
	Water	...	...	A sufficiency.
or				
	Gallic acid	...	...	$\frac{1}{2}$ to 1 drachm
	Jaggery	...	...	Sufficiency
every three hours.				

Diabetes.

One form of diabetes is occasionally seen in the elephant, characterized simply by profuse staling.

Causes.—In horses due to bad fodder and also to an undue proportion of saline matters in the water. It may be inferred that such causes may produce profuse staling in the elephant.

Symptoms.—Passage of large quantities of pale watery urine, thirst, and gradually increasing loss of flesh.

Treatment.—Care with regard to food and water, and change to another locality.

The following may be tried :—Iodide of iron in doses of 30 to 40 grains two or three times a day. Opium in doses of 2 drachms twice or thrice daily.

Tonics, especially arsenic, iron and nux-vomica, are indicated (Appendix—Tonics, Nos. 39 to 46).

CHAPTER X.

THE ALIMENTARY TRACT—DIARRHŒA—SUPER-PURGATION—CONSTIPATION—BELLY-PAIN, COLIC OR GRIPES—FLATULENT COLIC—INDIGESTION—ACUTE INDIGESTION—CHRONIC INDIGESTION—STOMATITIS—DISORDERS OF THE TEETH—INFLAMMATION OF THE BOWELS—DYSENTERY—EPIDEMIC DYSENTERY—INTESTINAL OBSTRUCTION—PERITONITIS—VOMITING—POISONING.

The Alimentary tract.

THIS consists of the *mouth* through which food and water gain entrance to the system, the former being ground into a pulp by the teeth and softened by the saliva; the *gullet* which conveys the same by the act of swallowing to the *stomach*, which is the receptacle for it, and in which the major part of digestion is carried on. By this act the food comes into contact with juices secreted by various organs, which juices have the power of altering the food and abstracting from it certain constituents which are required to replenish the wear and tear of the system. When this act has been sufficiently effected, the altered food passes into the *intestine*, a tube many feet in length, in which digestion is completed and the altered food passed onwards, acquiring more and more the character of fœces or dung, till it finally reaches the *rectum*, a dilated portion at the end of the tract, in which the fœces lodge till a certain quantity is collected and it is then discharged through the *anus*.

In health the interior of the mouth is pinkish in colour and moist, the breath not unpleasant, appetite good (the elephant in its natural state, as has been already remarked, eating from 18 to 20 hours during the 24).

The dung is passed from 8 to 12 times in the 24 hours and has the following characters:—

Colour.—When first voided, golden or reddish yellow, becoming varying shades of chocolate brown after some exposure to the air.

Form.—Voided in large lumps.

Consistence.—The masses are moist, but firm enough to frequently remain unbroken after being dropped.

Smell.—The smell is peculiar, but not disagreeable.

Substance.—Varies according to the characters of the food ingested, but usually contains a large quantity of fibrous material.

Any departure from the above characters may indicate disease of this tract and may be summed up as follows:—diarrhœa, constipation, colic, loss of appetite, depraved appetite, shown by eating dirt,

dryness of the mouth, or redness, pallor or sores, dung unduly hard or liquid, offensive, unnatural colour, admixture of slime or blood, or passage of worms.

Diarrhœa.

Definition.—A condition characterized by increased frequency in voiding dung, which may be merely softer than normal, or in severer forms quite liquid, and may be accompanied by griping pains. Diarrhœa should be regarded as a symptom and not a disease *per se*. In the elephant we may for convenience divide diarrhœa into three forms, namely,—

- | | | |
|---------------|--|----------------|
| (a) Ordinary. | \| | (b) Nervous. |
|  | \| | (c) Parasitic. |

(a) *Ordinary.* *Causes.*—A variety of causes tend to produce this condition, which are chiefly dietetic and may arise from the quality or quantity of food.

Diet: (a) *Quality.*—Coarse, indigestible, and innutritious, or succulent, rank, rapid growing grasses and sedges such as appear during the early rains, or poisonous plants, damaged or diseased grain. When grain, flour, &c., are damaged by wet or other cause and condemned as unfit for human consumption, it is by no means unusual for some one to propose that it had better be given to elephants or other animals; if such food is likely to prove baneful to the health of men, it is most likely to provoke illness amongst animals.

(b) *Quantity.*—An excess of food, especially in petted and pampered animals and those obtaining free access to large quantities of grain.

Poisons, administered wilfully or accidentally may occasionally be another cause.

Liver disease, by producing an excessive flow of bile.

Exposure, to cold and wet.

Water, drinking very cold water or bathing in it when the animal is heated. Water in certain localities charged with saline salts may induce an attack.

Diarrhœa is also often a symptom in specific fevers and is moreover a frequent sequel to constipation, masses of dung collect in the lower bowel causing irritation with increased secretion from the bowels.

Treatment: Preventive.—Lies in ordinary attention to the diet, water, shelter. The cause of the attack must be sought for and removed.

Curative: Local.—In severe cases enemas must be employed in conjunction with other methods; these must be small in bulk in

order that they may be retained (a few quarts), and the most beneficial are 2 or 23 ounces of tincture of opium added to three or four quarts of thin starch gruel.

General.—In a great many cases diarrhœa is merely an effort of nature to throw off some offending irritant from the bowels; it is therefore clear that in such instances our efforts should be to encourage it with caution; solid food must be withheld, especially grain, but a liberal allowance of rice, flour, barley, or arrowroot gruel sweetened with a little sugar should be allowed. These tend to soothe the irritated state of the bowels. Bael fruit when in season is a valuable adjunct to other forms of treatment, as also bamboo leaves. Drinking water, which should be given in tubs, must in the cold weather have the chill taken off and be allowed in moderation. In severe attacks stimulants such as rum, brandy, whisky, should be given in addition to astringents (Appendix 7 to 10, also *see* Mussauls). Perfect quietude is essential and good shelter (a tarpaulin or rug covering when cold) and a dry standing. When due to errors in diet, castor-oil one pint or a pint and a quarter is the best agent for removing the irritation. In bilious diarrhœa, when the dung is of a bluish green colour, liver medicines must be administered (Appendix Nos. 35 and 36).

Diarrhœa is at times very violent and requires drugs to aid the above (Appendix 7 to 10). When the dung is fœtid, sulphite or hyposulphite of soda in 2 ounce doses may be given with advantage either in drink or in bolus. When once improvement sets in, care must be taken only to allow small quantities of good clean fodder, gradually increasing this till the full ration is attained, but always being guided by the condition of the dung. The animal should be given gentle exercise, but not permitted to resume work for some days after the attack has subsided. This of course refers to severe cases. Enemas are also most useful (Appendix 82 to 84).

(b) *Nervous diarrhœa.*—This may be seen in fretful nervous animals. Any one acquainted with elephants or monkeys is aware how suspicion, fear, or excitement may suddenly produce an attack of diarrhœa. The cause being removed, it passes off almost as suddenly as it appeared; hence treatment is not required.

(c) *Parasitic diarrhœa.*—Is described under parasites, and no further mention is needed here.

Super-purgation.

Causes.—Excessive purgation, due to an overdose of purgative medicine, to undue action of an ordinary dose, or to repetition of a dose at too short an interval, or working an animal too soon after he has been given physic.

Symptoms.—Severe gripes, restlessness, watery evacuations, the animal refuses food, and the pulse soon becomes feeble.

Treatment: Preventive.—When circumstances permit, before giving physic, any grain ration allowed should be stopped 24 or 48 hours beforehand, and for some 24 hours previous the ordinary diet should be reduced; by so doing it will be found that less medicine will be required and that it operates better. Care must always be exercised, some animals being easily and violently purged. The state of the animal's health must be inquired into, whether he is at full work and on full feed, whether he has been on green or dry food, such as straw, boughs of trees, also the usual state of the bowels. It is usual and a good practice to combine the physic with some carminative, such as ginger, aniseed, gentian, cardamoms (Appendix 11 to 15). In some animals, even though every precaution is taken, violent purging may ensue. Large quantities of drinking water must not be allowed after the physic is given, though the animal should be permitted to take sufficient to allay thirst. If the water be very cold, the chill must be taken off. The animal must not be bathed till the effects of the physic have passed off. It often takes from 16 to 24 hours for the physic to operate, and its action continues for from 4 to 12 hours at intervals. If a purgative "hangs fire," a little walking exercise, or a soap-and-water enema, will hasten its action. Debilitated and otherwise delicate animals should only receive mild purgatives. Diet should be restricted while the animal is undergoing physic. Gruel in moderate quantity only is to be allowed. The animal must be kept quiet and the body clothed.

Curative—

<i>No. 1.</i>				
Opium	...	...	...	3 drachms.
Ginger	...	...	...	½ ounce.
Carraway seed	...	...	...	½ ounce.
Jaggery	...	...	...	A sufficiency.

Every four hours till relieved.

<i>No. 2.</i>				
Tincture opium	...	...	...	3 ounces
Sweet spirits of nitre	...	...	...	3 ounces.
Aromatic spirits of ammonia	...	...	...	1½ ounces.

Soaked in bread mixed with boiled rice and given in straw packets. Also some alcoholic stimulant, 8 ounces, two or three times a day, or--

<i>No. 3.</i>				
* Opium	...	...	...	3 drachms
Chalk	...	...	...	2 to 3 ounces
Catechu	...	...	...	2 ounces

twice daily.

* Ganja (Indian hemp) in doses of 3 to 4 drachms may be substituted for the opium,

Also see Appendix Nos. 1 to 10 and 82 to 84.

Constipation.

Like diarrhœa this is to be regarded as a symptom rather than as a disease. It is applied to a condition of the bowels in which the dung is unduly hard, and not, as is often supposed, total inaction of the bowels.

Causes.—It is a usual concomitant of fever and may be induced in a variety of ways; the quality of the diet, such as an undue proportion of dry fodder including grain; the astringent properties of the barks of many trees which they eat; certain astringent drugs; inactivity of the liver inducing a lack in the secretion of bile; habitual excessive food and insufficient exercise are among the more common causes.

Symptoms.—Are seen in the characters of the dung, which may vary from slight undue dryness of its substance, causing some difficulty in evacuating it, to a complete blocking of the alimentary canal, no dung escaping at all. In addition to being hard it may be darker coloured and often offensive; the animal usually has a dry mouth and at times is very thirsty, and generally drowsy.

Treatment: Preventive.—Consists in avoiding those causes enumerated above.

Curative: Local.—Enemas (Appendix Nos. 77 to 80).

General.—Consists of internal medication (Appendix Nos. 23 to 28, and 40).

Belly-pain, colic, or gripes.

Colic is a term applied to pain in the abdomen, commonly called gripes, or belly-ache. Two forms are generally recognized, namely, spasmodic colic and flatulent colic. The first is due to a spasmodic contraction of the muscular coat of the bowel; the second is caused by the intestine being distended with gas, due to the fermentation of food.

Causes.—The most frequent cause of colic is the presence of some irritant in the intestinal tract. Overfeeding and underworking animals predisposes them to attacks of colic, as they take in more nourishment than the system can assimilate; the accumulation of fibrous material when elephants are fed on branches of trees. Animals in poor condition are often the subjects of colic, which is due to want of tone in the digestive system. Eating large quantities of earth at times causes it; in such cases the bowels are often infested with worms. During the early rains colic is not uncom-

mon, as elephants eat large quantities of rank, rapid growing fodder, which at that period is unwholesome, as it contains very little nourishment and has a tendency to ferment. Dirty and unwholesome grain or fodder causing indigestion, may induce colic. Drinking a large quantity of cold water when the body is heated, and permitting an animal to drink too freely when fatigued by a long journey also act as causes. Tethered animals exposed to cold and wet may be attacked.

Symptoms.—Restlessness, swaying from side to side, moving the legs about, standing in different positions, beating the sides with the tail or trunk, yawning, inserting the trunk in the mouth, and grinding the teeth. The animal ceases to feed; lies down frequently, but only for a very short time. The pain is intermittent, that is, it occurs in paroxysms and is at times so intense that the patient groans, sinks down very suddenly, lies on his side kicking, only to get up almost as quickly as he went down. There is no fever. In some cases diarrhœa is present, especially in those where overfeeding, worms, are the cause; in other cases the bowels are constipated. As a rule urine is not passed

Treatment.—Copious enemas of soap and warm water (also *see* Appendix No. 81) fomentations to the belly, to which turpentine may be added. When severe fomentations are out of the question, mustard mixed with warm water must be applied, or liniment rubbed in over the belly—

*Opium	...	...	...	...	of each 4 drachms.
Powdered nutmeg	...	...	...	...
Aniseed	...	...	...	...
Rum	...	...	...	...	4 ounces.
Jaggery	...	...	...	...	A sufficiency.

Repeat in four hours if necessary, reducing the opium to $2\frac{1}{2}$ drachms, or—

Opium	...	...	...	...	4 drachms.
Ginger	...	...	...	...	1 ounce.
Jaggery	...	...	...	...	3 ounces.

Repeated in four hours if necessary, or—

Tincture of opium	...	...	...	...	3 ounces.
Sweet spirits of nitre	..	...	...	...	3 ounces.

Soaked in bread, or mixed with boiled rice, repeated if necessary in four hours (also *see* Appendix Nos. 1 to 6 and mussauls). When the acute symptoms have subsided, it is advisable to give a dose of physic, such as castor-oil, to relieve the bowels.

* If opium is not handy, ganja in doses of 3 or 4 drachms may be substituted.

Flatulent colic.

Symptoms.—In this form there are colicky pains, but as a rule they are not so acute as in the spasmodic form. The belly may be greatly distended; the bowels are generally constipated; the dung may be dry and hard, or soft and pale in colour; there is loss of appetite, dullness and listlessness; trunk contracted.

Treatment.—Similar to spasmodic colic, only that assafoetida in doses from $\frac{1}{2}$ to 2 ounces, and ginger 1 ounce, may be combined with opium in lieu of other drugs; or hyposulphite of soda in from 1 to $1\frac{1}{2}$ oz. doses mixed in a bucket of gruel or water may be given every hour.

The bowels must be relieved by enemas (Appendix 80 and 81) and, when the attack has subsided, a purgative should be given. In all cases of colic attention must be paid to the water and fodder and, if either be found indifferent, the animals must be removed to other pasture. After an attack of colic food must be given sparingly for a few days.

If colic be not relieved early, the case may end fatally. Steel records entanglement of the bowels as a cause of death. This is usually brought about by the violent manner in which the animal throws himself about when in acute pain.

Indigestion.

Definition.—By the term indigestion we understand that the digestive system is deranged. It may be acute or chronic.

Acute Indigestion.

Causes.—Irregularities of the teeth interfering with proper mastication of the food, coarse dry indigestible fodder, damaged grain, overloading the stomach with an excessive quantity of food. I have known a heavy feed of grain off a threshing floor to cause a severe attack.

Symptoms.—Drowsiness, disinclination to work, loss of appetite, constipation, sometimes acute abdominal pain.

Treatment.—Should be prompt. A smart purge of castor-oil one pint, with croton oil 15 drops, to which may be added $\frac{1}{2}$ an ounce of tincture of opium if pain is severe, and the resulting constipation treated by enemas or laxatives. Starvation for some hours, after which nothing but gruel for twenty-four hours should be given, when, if the dung is natural, ordinary food may be allowed in small quantities and gradually increased, carefully watching the excretions.

Chronic Indigestion.

Causes.—An acute attack which has remained uncured, want of change of diet, highly stimulating food, such as the free use of mussauls, insufficient exercise, liver disease, intestinal parasites. In young animals too early removal from the dam, or compelling the dam to work shortly after the birth of the offspring, or allowing the calf to suckle when the mother is heated, or at long intervals. It is most usually met with in very young or very old and debilitated animals.

Symptoms.—The animal is dull, appetite poor, thirst great, the skin harsh and dry; if worked, he is sluggish; the membranes of the mouth pale or yellowish in colour; if the hand is placed in the mouth, it will be found to be sticky. The condition of the bowels vary: in some cases they are constipated and the dung is passed in small quantities accompanied by a good deal of flatus, the fœces being hard and dry and consisting mostly of unaltered fibre, or the bowels may be relaxed, not always diarrhœa, but the evacuations soft, and a quantity of fluid may be passed at the same time. If the dung is examined, a good deal of grain may be found in an unaltered state, clearly proving that digestion is not being properly performed, or that the food itself is unsuitable and indigestible. The dung often possesses a sour, nasty smell, and varies in colour; it may be nearly black, clay blue, or of a peculiar greenish yellow. Animals suffering from indigestion often have a tendency to eat earth.

Treatment.—The teeth must be examined for irregularities, the mouth for sores. The evacuations must be carefully examined, as also the food and water-supply. A change of food should be tried without delay, and an extra quantity of salt allowed. If the bowels are constipated, a dose of physic should be given or, better still, enemas (Appendix 77 to 80). When diarrhœa is present, unless severe, it should not be checked, as the bowels may thus be relieved of some irritating material. They must be kept regular by gentle laxatives, or enemas and exercise. To restore tone to the digestive organs, vegetable and mineral tonics are indicated, such as the following:—

<i>No. 1.</i>			
Arsenic	...	...	2 to 3 grains.
Bicarbonate of soda...	...	...	4 drachms.
Ginger or gentian	...	...	1 ounce.

Once or twice daily for a week or ten days after food.

<i>No. 2.</i>			
Powdered nux-vomica	...	...	½ drachm.
Powdered sulphate of iron	...	...	2 drachms.
Powdered chiretta or ginger	...	...	6 drachms.

Mix and give for one dose twice a day.

No. 3.

Fenugreek	...	12 ounces.
Aniseed	...	6 ounces.
Carbonate of iron		2 ounces.
Black pepper	...	4 ounces.
Ginger		4 ounces.

To be reduced to powder and well mixed. Two ounces for a dose, once or twice daily (also *see* Appendix 11 to 14).

Above all, strict attention to diet, which should be good, clean, and nutritious; grain should be withheld for a time. Work should be stopped and, when possible, the animal given a change to some grazing.

Stomatitis, or Inflammation of the Mouth.

Causes.—A result of impaired nutrition, perhaps wholly due to enfeebled digestive power.

Symptoms.—Loss of appetite, which may be actual or only apparent owing to the soreness of the mouth, an investigation of which reveals in the early stages increased redness, but later on actual sores. The condition is generally attended by constipation.

Treatment: Local.—If the animal will permit, wash the mouth out with permanganate of potash 2 grains to the pint, or alum 1 drachm to the pint, or borax 10 grains to the ounce, or chlorate of potash 10 grains to the ounce; failing this the same remedies reduced to half the above strength must be brought into contact with the inflamed surfaces through the drinking water. The addition of a little sugar may entice the animal to take it. Borax and chlorate of potash in equal parts mixed with sugar or honey is perhaps the most tasteless, and may be rubbed in the mouth every hour.

General.—Plenty of fresh gruel and soft food; keep the bowels regular, and give tonics (Appendix Nos. 39 to 46).

Disorders and Irregularities of the Teeth.

Causes.—A frequent cause of trouble is the formation of tumours, which are simply due to an abnormal and excessive development of parts of the teeth. They may assume considerable dimensions. Owing to their interference with the process of mastication, great loss of condition may ensue. It is one of the causes of indigestion, colic, and debility.

Symptoms.—Difficulty in mastication; very often half masticated food is dropped from the mouth; general unthriftiness.

Treatment.—The only method of any avail is removal by operation. The animal to be operated on must be made to assume the recumbent position, be properly secured; a gag having been applied, the mouth should be carefully inspected. The growths may be removed with a fret or other fine saw; the working of the saw is greatly facilitated by dripping water on it from a sponge or cloth. Small growths may be removed with a cold chisel. The diet of course should be soft and nutritious as is procurable.

Occasionally a tooth may be displaced from its normal position owing to the presence of some morbid growth about the root, or fang, and thus interfere with mastication by its irregularity, or from the animal lacerating the mucous membrane during mastication; loss of condition follows. The offending portion may be removed with a saw.

Owing to the peculiar manner in which the teeth are replaced, the front teeth are liable to loosen and be shed. This is termed "*Koochlie*" by the Indian mahouts. It is a natural process.

Carious teeth.—Caries of the fang of a tooth does occasionally occur. In the case of a wild elephant I shot, observing a tumour on the lower jaw, I examined it and found that it proceeded from the fang of a molar tooth, which was in a very diseased condition. This elephant was given to roaming about alone, and was not in very good condition. The tusk on the same side was also extensively diseased.

While on the subject of teeth, it will be convenient to consider the tusks.

It is sometimes necessary to cut off a portion of one or both of the tusks; for instance, when they are badly split, or cross one another. The operation is simple, an ordinary saw being used; the saw is kept constantly wet with a stream of water. Hawkes gives the following directions for finding the proper place to cut the tusks:—"Measure with a bit of twine the distance from the eye to the insertion of the tusk in the lip, this length measured from the latter point along the tusk will give the spot where it should be cut. Sometimes, however, especially in young animals, this site is too near the root, as the pulp of the tusk may reach beyond the point thus fixed, in which case it bleeds after the operation and frequently causes the tusk to split and decay." The advice given by Colonel Hawkes is very sound; the tendency with Indian mahouts is to suggest cutting off the tusk a bit too close. Care should therefore be taken to cut off too little, rather than too much. Should the whole tusk split up to the root, as sometimes happens, the Indian mahouts recommend that it should be completely cut off at the point where it touches the gum, and this has been done with great relief to the animal—(*Hawkes*).

If a tusk shows any tendency to split, it should be capped with brass or iron, or an iron band applied; it should be put on hot and shrunk on as a tyre is applied, but of course the temperature should be much lower in the former case; or fitted with a ring, which is forcibly driven on to the tusk till it maintains a secure hold. This is the better method.

Tusks that have been shortened often show a tendency to split.

In the female and so-called tuskless males, the tusks are liable to be broken off, or to become diseased.

Should there be a cavity, it must be cleaned and washed out with permanganate of potash 2 or 3 grains to the pint, and then dried, after which it should be plugged with a single piece of tow or cotton wool, medicated with a few drops of carbolic acid, creosote, or oil of cloves.

If it should happen that too much of the tusk has been cut off and the pulp exposed, the following treatment should be adopted. The bleeding is not, as a rule, very excessive; the injured part must be washed or syringed out with a warm, weak solution of permanganate of potash 2 or 3 grains to the pint, or carbolic lotion 1 to 60, or thymol 10 grains to the pint of hot water, after which the part may be dressed with carbolic oil, idoform ointment, camphorated oil, &c. (Appendix Nos. 121, 122, 128, 129), and then carefully bandaged. Hawkes employed an ointment, which I can strongly recommend; it is as follows—

Dikamali	...	...	5 tolas, i.e., 2 ounces approximately.
Bees-wax	...	...	5 tolas, i.e., 2 ounces approximately.
Gingili-oil	...	...	6 tolas, i.e., 2½ ounces.
Gall-nuts (powdered)	...	...	2 tolas, i.e., 7 drachms.

Boil the gall-nuts in the oil and add the Dikamali; when this has melted strain through a cloth; lastly add the wax and stir till cold. [Dikamali is the Madras term for the resin from the *Gardenia lucida*, a most useful ingredient in ointments, as it is healing and at the same time repels flies.] Hawkes recommends that the ointment be rubbed over the end of the tusk and then covered over with a cotton rag; over this a second piece of rag saturated in coal tar, or neem oil, i.e., margosa-oil (*Asadirachta Indica*) may be bound. Dress every second day.

Great care should be taken to see that flies are kept off, otherwise the wretched animal, owing to the presence of maggots, may have to endure fearful suffering.

Enteritis, or inflammation of the bowels.

Causes.—Obstruction, severe constipation, neglected diarrhoea, parasites, action of acrid plants or drugs, chills, &c. It is said to

be not infrequent in the hot season if elephants are fed largely on the leaves and branches of the *peepul*, *nyaung-bin* (*Ficus religiosa*).

Symptoms.—During the early stages some constipation and passing of mucous or slime, later on diarrhœa with slime, belly-pains which differ from ordinary colic in that the pain is continuous and increases in intensity as the diseased condition of the bowel advances. Fever is always present, which at once distinguishes it from colic.

Prognosis—Unfavourable, frequently fatal.

Treatment: Preventive.—Consists in attention to avoiding causes noted above.

Curative: Local.—For the relief of pain as described under that condition, *i.e.*, fomentation, turpentine stupes, mustard plaster. Occasional enemas of warm water may afford relief. Diarrhœa as described under that condition.

General.—Opium in 2 drachm doses every two hours till 8 or 10 drachms has been administered; it not only relieves the pain, but keeps the bowels quiet, a very important matter in this malady. Tincture aconite in 30-drop doses every three or four hours, if fever is high, may be tried. Plenty of linseed gruel should be allowed, also stimulants. Purgatives must on no account be given. If the animal recovers, bring him gradually on to his full ration. No harm will be done by keeping him short till he has quite recovered.

Dysentery.

This condition is manifested by intermittent griping pain accompanied by discharge of liquid dung mixed with blood and slime.

Causes.—Generally due to chill, but may be a sequel of diarrhœa, indifferent food and water.

Symptoms.—Fever with its attendant signs already noted; abdominal pain most noticeable during the act of voiding the dung, which act may be accompanied by severe straining. The matter passed is liquid, often foul smelling, and contains either blood or slime, or both.

Prognosis.—Favourable under early and careful treatment.

Treatment.—Exactly as already noted under diarrhœa, to which may be added freshly powdered cinnamon in 6-drachm doses, and enemas containing boracic acid 5 ounces to 4 pints of boiling water, which must be allowed to cool before use; a couple of quarts of this should be injected two or three times a day or

Epidemic dysentery, or murrain.

Such a condition has been described, which does not differ in symptoms or treatment from the above, but as it attacks several animals simultaneously it must be regarded as infectious or contagious, and beasts so affected must be isolated with the same precautions as laid down under anthrax. The mortality mentioned is 80 per cent. I have never seen this condition in elephants, but I have seen a similar condition among buffaloes in this province at the end of the hot season, when after the first few showers the young grass crops up rapidly. It may be due to the entrance of a micro-organism. The disease was as fatal as severe cattle plague.

Intestinal obstruction, or stoppage of the bowels.

Causes.—Collection of food and blocking of the bowel, or a twist of the gut.

When elephants are left entirely to their keepers it is not uncommon for them to feed the animals entirely on branches of trees, being too lazy to cut grass for them. Some barks are very astringent and contain a large amount of woody fibre with a small amount of sap, which is difficult to pass along the bowel, and tends to collect and eventually produce stoppage.

A surfeit of grain, especially in animals not usually allowed any, thus partaking of it in large quantities, may also provoke this condition.

Symptoms.—Restlessness, off feed, distended abdomen, severe continued pain, with total absence of passage of wind or dung. If not quickly relieved, the symptoms become aggravated, distension and pain grow worse, severe fever sets in and death may ensue rapidly.

Treatment.—Avoid all purgatives, which will only aggravate the condition; but the following may be tried, namely, extract of belladonna 2 drachms mixed with jaggery. This may be repeated in four or five hours. The rectum should be emptied by hand, after which copious enemata of soap and hot water (at a temperature which will bear the hand comfortably) to which 2 to 3 ounces of oil of turpentine is added should be thrown up, and repeated without the turpentine every half hour or so till relieved. Pain must be relieved, as mentioned under that condition. If the obstruction is relieved, every care with regard to food must be observed as laid down under severe diarrhœa.

Peritonitis.

Inflammation of the glistening membrane which lines the abdominal cavity and is reflected over the bowels, &c.

Causes.—It may occur as an independent disease, due to exposure to wet and cold, or resulting from inflammation or obstruction of the bowels, but more commonly in elephants it is caused by punctured wounds of the abdomen, the result of goring, or falling on sharp stakes.

Symptoms.—Very similar to those of obstruction just mentioned ; high fever is an early sign.

Prognosis.—Unfavourable, usually running a rapid and fatal course.

Treatment.—Must be according to the symptoms and consists in relieving pain as laid down under that condition. As the bowels require perfect rest, enemata must not be used, and food must be given in the form of gruels only. Stimulants, such as brandy, rum, may be administered at intervals. Wounds must be carefully treated as laid down under punctured wounds (*see* page 166).

Vomiting.

Though emetics appear to have no action on the elephant, vomiting in a severe form is occasionally met with. Gilchrist and Hawkes describe the condition, the cause being ascribed to washing an animal immediately after coming off a journey when much heated.

Symptoms.—An elephant apparently quite well suddenly commences to vomit freely ; great irritability of the stomach is manifested by the animal being unable to retain liquids or solids for some hours after the commencement of the attack. When the irritability subsides, the animal will take food, but after swallowing the pellet it may become impacted in the gullet and soon after even the power of swallowing is lost. A lump may sometimes be felt in the neck indicating the seat of the impaction. There is great distress and the condition is accompanied by hiccough. It may occur at any season of the year.

Prognosis.—Unfavourable, unless relief is promptly afforded ; death ensues in from three to four days. For some hours previous to death the surface of the body is extremely cold.

Treatment.—All solid food must be withheld until the animal is well over the attack, after which small quantities may be given sparingly, care being taken to watch for any symptoms of difficulty

in swallowing ; plenty of well-boiled rice and gruel may be given after the acute symptoms have subsided.

To try and allay the vomiting, the following may prove beneficial :—

Subnitrate of bismuth	...	...	4 drachms.
Bicarbonate of soda	...	...	4 drachms.

Mixed with honey, a little should be rubbed into the mouth every few minutes.

Extract of belladonna 2 drachms, rubbed down in glycerine and mixed with a few ounces of treacle, may be given in a similar manner.

If the animal can drink, $\frac{1}{2}$ an ounce of bicarbonate of soda may be added to a bucket of water and repeated in a few hours.

Should an obstruction be observed in the neck, the hands must be well oiled and the swelling gently massaged or manipulated from above downwards in the hope of facilitating its onward progress. When the animal is better, enemas may be employed to relieve the bowels and several days' rest allowed.

On *post-mortem* examination the gullet is usually found in a state of mortification in the region of the impaction ; in some cases it was found impacted throughout its extent and in two cases all the other organs of the body were in a healthy condition.

Poisoning.

Steel records some very interesting cases of wholesale poisoning of elephants in India by means of the poisonous Nepaul root, called "*darka*," being given in balls of grain, or other delicacies, of which these animals are fond. In this Province I have never heard of tame or wild elephants being intentionally poisoned. We must nevertheless be on our guard as such a thing is possible. Many poisonous drugs are administered by mahouts in the treatment of elephants ; an overdose might be given through ignorance or carelessness, or by accident. Elephants are very particular as regards the selection of their food ; still a case of poisoning might occur. In two cases where animals died rather suddenly, arsenic was detected in the contents of the stomach by the Chemical Examiner. I have little doubt that these animals were being treated by the mahouts with bazaar arsenic, which is often very impure.

The symptoms manifested which might lead us to suspect poisoning are that they occur suddenly, generally while an elephant is in perfect health. As a rule, they arise soon after food has been taken or medicine administered. If more than one animal is taken ill after food or medicine, and all suffer from similar symptoms, the detection of poison will probably be found in the food.

The poisons we might have to deal with are those employed in treatment, such as arsenic, opium, belladonna, croton beans, or croton oil, ganja, dhatura, nux-vomica, metallic salts.

For the treatment of poisons antidotes are administered; they act in two ways, either by preventing the action of the poison or counteracting its effect.

Poisons and their antidotes.

Poisons.	Antidotes.
1. Arsenic ...	... Preparations of magnesia.
2. Aconite ...	... Tannic acid, and animal charcoal.
3. Opium ...	... Dashing cold water over the body, stimulants; endeavour to keep the animal moving about. Permanganate of potash.
4. Belladonna ...	... Keep the animal moving about; give lime-water and stimulants; dash cold water over the body.
5. Croton beans, or oil ...	... Demulcent drinks; stimulants, and opium to relieve pain and check the purging.
6. Ganja ...	... Stimulants; keep the animal moving about.
7. Nux-vomica, or strychnia...	... Bromide of potassium; weak decoction of tobacco.
8. Tobacco ...	... Warm stimulants, tannic acid, and small doses of strychnia.
9. Metallic salts ...	... Steel states that "the formation of tumours over the body, progressive anæmia, and even disorders of the feet have been attributed to the empirical use of the compounds of mercury in too large quantities." Plenty of white of eggs, wheaten flour conjee, and other demulcent drinks.
10. Acids ...	... Alkalies such as carbonate or bicarbonate of soda or potash.
11. Carbolic acid ...	... White of eggs, demulcent drinks, stimulants.

The dose of poison is usually so large that treatment is of little avail. Antidotes are not always procurable in time to be of service; again the elephant is often an awkward animal to give drugs to, and such things as inhalation of ammonia are impossible.

If a death occurs under suspicious circumstances, a *post mortem* should be held, notes taken, and some of the contents of the stomach and commencement of the small intestine, small piece of liver and kidney should be placed in clean jars, with some spirit, sealed with a private seal by some responsible person, and despatched without delay to the Chemical Examiner, who will readily aid and give his opinion on the case.

CHAPTER XI.

INTERNAL PARASITES—SYMPTOMS OF THE PRESENCE OF PARASITES.

Internal parasites.

PARASITES IN THE ALIMENTARY CANAL.

THIS is a subject of the greatest importance, and is deserving of the careful and earnest attention of all those persons who may be placed in charge of these valuable animals. Though Gilchrist, in his work on elephants, published in 1841, and others since then have mentioned the subject, we owe the greater part of the knowledge we now possess to the late Dr. Cobbold, the eminent Helminthologist, and Colonel Hawkes, late of the Commissariat Department. It may be accepted as a fact that elephants in Burma are much troubled with parasites. It is exceptional not to find them in the intestines, or livers of tame, and even wild elephants after death. Elephants in India seem also to be much troubled with them. Forsyth writes: "Elephants are very liable to intestinal worms. They generally cure themselves, when they get very troublesome, by swallowing from 10 to 20 pounds of earth. They always select a red-coloured earth for the purpose. In about twelve hours purging commences, and all the worms come away."

Cobbold, writing on the important part played by internal parasites in the production of endemics and epizooty, remarks: "Depend upon it, many a death, hitherto reported as resulting from inflammation of the intestines, colic, splenic apoplexy, sunstroke, or to some other obscure cause has been primarily due to entozoa, the presence of which may not even have been suspected during life."

The parasites most likely to be met with are—

- (1) *Gastrophilus elephantis* (see Fig. 27).
- (2) *Ascaris lonchoptera* (see Fig. 28).
- (3) *Amphistoma Hawkesii* (see Fig. 29).
- (4) *Fasciola Jacksoni* (see Fig. 30).
- (5) *Dochmius sangeri*.

(1) *Gastrophilus elephantis*.—*Gastrophilus elephantis* is the larva, or maggot, or "bot" of a gad-fly, and may be found in the stomach or upper gut. In the stomach, the "bots" adhere by

means of cephalic or head hooks, which they insert into the mucous membrane. After attaining a certain growth they voluntarily release their hold and are carried down the intestinal canal, until they eventually escape with the dung. In appearance "bots" when fresh resemble whitish red grubs, about an inch in length; the body is divided into eleven segments, and the hooks by which they adhere are often visible without the aid of a lens. During the passage down the intestinal canal they may re-attach themselves. I met with one fine example of this, where not less than eighty "bots" were attached to the mucous membrane of the upper part of the gut. On escaping from the bowels, they bury themselves in the ground, where they change into the pupal condition, and in due course they emerge from their cocoons as full blown dipterous insects (gad-flies). There is little doubt that "bots" when present in large numbers must cause trouble; but unless passed per anum it is impossible to diagnose their presence.

Steel records that a "bot" (*Pharyngobolus Africanus*) has been found in the pharynx of the African species. I have not heard of it in this country.

(2) *Ascaris lonchoptera*.—Termed "soorti" or "chotee" by the Natives of India is very common indeed, but, unless searched for, is liable to be overlooked. It is a round worm, from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in length, about the thickness of fine twine, is semi-transparent, and of a whitish yellow colour. Large numbers of these parasites may be present without apparently causing any inconvenience. They are found in the intestines.

(3) *Amphistoma Hawkesii*.—This parasite is well known to mahouts. Colonel Hawkes in May 1875 sent some specimens of this parasite to Dr. Cobbold, who, finding them new to science, named them after the donor. They are by no means uncommon, and are termed "masuri" or "mussodee" by the attendants, but, owing to the large quantity of fœces passed at a time by elephants, and the small size of the parasites, attention is not attracted to them. Their abode is the large intestine, to the membrane of which they adhere by means of their suckers. They are of a delicate flesh pink colour. Steel gives their size as $\frac{3}{8}$ — $\frac{1}{4}$ inch. Sometimes, however, we find specimens measuring $\frac{5}{16}$, $\frac{7}{16}$ inch. They are not unlike barley-corns in appearance.

They may on examination be readily recognized under a lens by the presence of a circular sucker, placed at each extremity of their bodies.

It is only when they are present in very large numbers that they set up much irritation of the bowel, causing severe and frequently most persistent diarrhœa, during which a truly marvellous num-

ber of the parasites may be expelled. It is a matter of common remark amongst mahouts that, when elephants are troubled with parasites, they resort to eating earth for the purpose of inducing purgation, in order to rid themselves of these unwelcome guests. The eating of earth may go on for a couple of days, the amount eaten being from 2 to 4 pounds at a time, until free purgation is produced, after which no more earth is eaten. Steel, however, proved that this eating of earth is not the whole and sole cause of purgation. This habit of eating earth does not always denote the presence of parasites. It frequently points to the fact that an animal is not receiving salt, or, if a ration of salt is allowed, that it is insufficient. Wild animals, that is, deer, bison, sine, and elephants make frequent and regular visits to "licks" and eat quantities of earth, and, though in the jungles one frequently sees the droppings of wild animals, it is not often that one finds parasites. This parasitical diarrhœa often proves fatal, especially in young animals and in adults when in a low state of health.

(4) *Fasciola Jacksoni* (liver flukes).—The term "fluke" has been applied owing to its flatness, being likened to the fish known as the fluke or flounder. It has a somewhat rounded outline and when examined under a glass it will be seen that the body is covered with minute spines. By a peculiar arrangement in the structure of the sucker, these creatures are enabled to adhere to the mucous membrane of the bile ducts with such tenacity as to resist the contraction of the bile ducts to expel them with the bile into the intestinal canal. The colour varies a great deal, depending to a great extent on the amount of bile they contain; if their digestive system be full of bile, the colour is a dark brown or greenish black; if empty, a dark yellowish brown.

Cobbold gives the length, when unrolled, from $\frac{1}{2}$ to $\frac{5}{8}$ inch and the breadth from $\frac{1}{3}$ to $\frac{1}{2}$ inch. The habitat of flukes is in the bile ducts of the liver, which they invade from the opening through which the bile flows into the gut, situated a short way from the stomach, and it is to their presence that the disease known as "rot" owes its existence. In Burma flukes may occasionally be met with in mules and ponies, but more frequently in oxen, buffaloes, and elephants. Hawkes, a careful observer, who knew much about the diseases of elephants, constantly found after death these parasites in the bile ducts. This has frequently been my experience. While he was stationed at Secunderabad a high mortality occurred amongst the elephants under his charge. He attended the *post-mortem* examinations, and flukes were found in greater or less numbers in every case; he also observed that other parasites were met with. A long account of an outbreak of "rot"

which occurred in 1867 amongst the Commissariat elephants stationed at Rangoon is given in a letter to the *Rangoon Times*, dated the 16th July 1867, and signed R. B. It appears that in the short space of 15 days seven elephants died, and it was noticed that the mortality commenced as the severity of the south-west monsoon increased. The outbreak was such a remarkable one that I give some extracts from the letter—

“6. The first sign I noticed of the disease was the number of elephants which resorted to eating mud, the natural remedy provided by the animal's own instinct for the expulsion of intestinal worms. Perhaps the animal resorts to mud not only as a remedy for worms, but also when any excess of irritation in the bowels or stomach is felt; however, be that as it may, in all the cases which came under my notice, I am confident the cause of death was from the presence of cystic and larval forms of the entozoa, which were found in abundance in the liver, lungs, and intestines of the animal.

“7. In the lower bowels or alimentary canal the common worms were found in great numbers, termed “chotee” or “mussodee” in Dr. Gilchrist's *Treatise* (a species of *ascarides*?), and it was not until the liver and lungs had incisions made in them that the other kind was discovered.

“8. The inside of the liver and cavities of the lungs were, I may say without exaggeration, positively alive with this species of *distoma* for I believe it to be such, at least as far as I am able to judge in comparing its diagnosis with those mentioned in *Davaine Traite des entozoaires*, of which at pages 49 and 322 a very accurate description is given, with the exception of some slight variations, which only determine this to be a different species.

“9. The form of the one (a specimen is herewith sent) now spoken of is somewhat more round, which I think may be likened in shape to the old-fashioned lady's reticule, and of about the size of the nail of the forefinger. The body is compressed, soft, with two distinct orifices—one marginal, forming as it were a small pointed distention on its margin, the other between the middle and anterior sixth of the body. Just above the ventral orifice there is a kind of elongated appendage or sucker, in length about the same as the body, but when pulled out by the forceps extends beyond the margin; it appears slightly elastic with the end distended. Under the microscope the external covering or epidermis appears pitted and, when subjected to the action of dilute nitric acid and mounted on a slide in Canada balsam, the intestinal ducts are plainly visible containing dark coloured granules, being free near the orifices, but thickly reticulated towards the margins with clavate terminations. There are, as far as I could discover, no hooklets in mouths, as

stated to be in *echinococcus* or *larvæ* of *taeniæ*. From the absence of these characteristics, I have been led to conclude it to be a species of *distoma*.

" 11. Davaine mentions that animals such as the ox and horse frequenting marshy, swampy places are subject to the *distoma*. It is most probably the truth, but I think during very prolonged hot weather, when the water is reduced to its lowest stagnant state and mixed with the lower organisms of animal life, the elephant then imbibes them with the water in their embryonic form. In this opinion, I believe, I am in a great sense supported, for from inquiry I find the virulent diseases which have attacked cattle in Burma have been during a heavy monsoon, after a continued hot season.

" 14. The disease is not one which develops its symptoms by different stages, but carries the elephant off in a few hours and might, I am sure, be taken for apoplexy, or inflammation of lungs, for the symptoms correspond in character with those described by Dr. Gilchrist. The elephant exhibits difficulty in breathing; it keeps its mouth open, is restless in most cases, and refuses food; there is a puffiness about the head and shoulders.

" 15. Besides the Commissariat Department, others have suffered in the loss of elephants. The Forest department lost their elephants, and reports have reached me that wild elephants have died. This may be, for the wild elephants in a droughty season are necessarily subject to the same influences as the trained ones. I would particularly mention that those elephants of this department which were during the hot weather kept in the cattle lines, partially in sheds and well cared for, have up to this time escaped.

" 16. The sufferers have been those sent from the scarcity of forage to the jungles to graze."

With reference to this outbreak the symptoms appear to have developed suddenly, and the disease to have run a very rapid course. Though the writer in paragraph 8 mentions that "the inside of the liver and cavities of the lungs" were alive with *distoma* (another name for the fluke), I venture to think that in spite of his being unable to discover no "hooklets," paragraph 9, that the *cystic* forms alluded to as met with in the liver and lungs were most probably hydatid cysts; for these cysts are occasionally met with in the liver, lungs, and other organs. In paragraphs 15 and 16 it will be observed that the elephants that were kept in the lines escaped, while those only that were sent out to graze contracted the malady. There is no doubt that flukes and amphistomes were present in these cases.

The natural history of the *Fasciola* or *Distoma hepaticum* of the sheep has been carefully worked out, and to those interested in the life history of this wonderful parasite I would recommend a

small book by J.B. Simonds on "*The Rot in Sheep*," also Cobbold's works on parasites. It will be sufficient to state here that the progressive changes and transformation through which this parasite passes from the egg to the mature fluke take place outside the body of the creature they ultimately inhabit. They enter the body in their penultimate form and are parasitic only in their mature state. They do not multiply in the body. It is a well established fact that the "fluke" disease or "rot" is essentially a disease of lowlying, inundated tracts, and wet seasons. There is little doubt that many of the cases, called "*thut*" by the Burmans and *Zahirbad* by the Indians, are true "rot."

As is the case in most ailments due to parasites, the early symptoms of "rot" are ill defined, and may not even lead to a suspicion of the cause.

In these diseases the symptoms depend on the number of parasites and inconvenience caused by their presence, and also to the importance in the animal economy of the particular organ invaded.

A few flukes in the bile ducts may give rise to but slight irritation and impairment of function; whereas, when they invade the ducts in large numbers, the pressure and persistent irritation caused may lead to such rapid and extensive structural alterations as to speedily cause death. Under certain conditions the progress of "rot" may be very rapid, such as in animals that are hard worked, ill fed, exposed to all weather; also in cases where animals already in a debilitated state are attacked. Young animals are sometimes invaded by such large numbers of flukes that they impair the function of the liver to such an extent as to rapidly destroy life.

As a general rule the progress of "rot" is slow; one constant symptom is progressive wasting away, due to anæmia. This is not surprising when we know that an organ of such importance as the liver is the seat of disease. The secretion of the liver, namely, the bile, has a most important office to perform. When the ducts are crowded by these creatures, the pressure, irritation, &c., must lead to impaired secretion and consequent alteration in the quality and quantity of the bile. The gland gradually ceases to perform its office in an efficient manner, thus the blood becomes affected and impure in quality. The flukes as they become mature travel up from the main channel into its numerous ramifications in the liver, for the purpose of depositing their eggs. The result of this persistent irritation is increased vascular action, which leads to the coats of the ducts being considerably thickened and their calibre decreased.

(5) *Dochmius sangeri*.—As far as I am aware, not found in Burma. Males measure $\frac{3}{8}$ ", females $\frac{3}{8}$ "—(Cobbold).

Symptoms of the presence of parasites.

(1) The *Gastrophilus elephantis*.—Wanting ; presence known by occasionally observing them in the dung.

Treatment—Dose of physic.

(2) *Ascaris lonchoptera*.—Symptoms trifling, or more often absent ; presence known by inspection of dung.

Treatment—Dose of physic and enemas (Appendix 85 and 86).

(3) *Amphistoma Hawkesii*.

(4) *Fasciola Jacksoni*.

(5) *Dochmius Sangeri*.

} May be taken together.

Symptoms are dullness, lassitude, frequent yawning, general unthriftiness shown by a dry scurfy skin ; the appetite fastidious, one day the patient eats well and on the following day is "off feed" possibly only eating earth ; thirst is frequent, the membranes are pale or yellowish in colour, the mouth clammy ; there may be puffiness about the head and shoulders ; frequent attacks of severe, and often persistent foetid and dark coloured, diarrhœa, which usually contains specimens of the offending parasite ; this symptom is particularly pronounced in the case of *amphistomes* ; there is gradually or rapidly progressing debility and rapid loss of flesh ; later on dropsical swellings, finally extreme exhaustion, ending in death.

Treatment : Preventive.—Consists in following out what has already been laid down with regard to the management of the elephant in health with especial reference to food, which must not be procured from wet or marshy tracts (wet being essential to the development of these parasites), good water, and *an ample allowance of salt*. When flukes are discovered, the animals *must be removed to high ground*.

If mahouts carefully inspect the dung daily as they should do, their presence would often be discovered at an early stage before the elephant becomes debilitated, and successful treatment and early restoration to health would probably ensue. Inspection must be close and careful, for these dangerous parasites are very small and their presence very easily overlooked.

The dung of any animals found suffering from worms must be collected and mixed with carbolic powder or chloride of lime or destroyed by fire.

Diarrhœa need not be checked unless very severe or the animal very weak. Stimulants such as brandy, rum, &c., are at such a time of service.

Curative.—See Vermifuges, Appendix 47 to 53, Tonics, 39 to 46, also 85 and 86.

Tonics, especially arsenic, sulphate of iron, copper and nux-vomica, most useful during convalescence.

CHAPTER XII.

THE LIVER—JAUNDICE—HEPATITIS, OR INFLAMMATION OF THE LIVER—HYDATIDS.

The liver.

THE liver is the largest gland and one of the most important of the digestive organs. Its chief function is that of secreting bile which finds its way through ducts into the intestine and assists in the digestive process. There is no gall bladder and the organ weighs 50 to 55 pounds. Bile is a natural laxative, prevents putrefaction in the intestine, and is the colouring agent of the dung. An over secretion of bile tends therefore to create diarrhœa with deep coloured motions. Insufficient secretion on the other hand may produce light coloured and foul smelling dung, with constipation. Characters of the dung therefore give much information regarding the liver.

Faundice is a condition manifested by yellowness of the membranes, deep coloured greenish urine, and often light coloured dung, and is due to an absorption of bile into the blood. It is an indication of liver disease, but is rarely seen in elephants.

Treatment.—The bowels must be kept regular by means of laxatives such as Epsom salts. Grain should be discontinued and the amount of fodder reduced till the attack passes off.

Hepatitis, or inflammation of the liver.

The liver like other organs is liable to undergo inflammation, but disease is rare; the symptoms are often obscure, so that the condition may be only recognized after death. There may be, however, certain symptoms pointing to this affection which may be either acute or chronic.

Causes.—Exposure, chill.

Symptoms: Acute.—Fever with its attendant signs, muddy or yellowish coloured membranes, dry clammy mouth with tainted breath, irregularity of bowels, sometimes dark coloured diarrhœa, high coloured greenish thick urine, and abdominal pain.

This may run on to abscess, several cases of which have been recorded.

Treatment.—As for fever, and in addition enemas and purgatives such as—

Aloes	...	...	...	...	6 drachms.
Calomel	...	...	...	...	1 drachm.

See Appendix—Laxatives, Nos. 23 to 28.

Chloride of ammonia is most useful in doses from $\frac{1}{4}$ to 1 ounce twice a day, or bicarbonate of soda in $\frac{1}{2}$ ounce doses, or Epsom salts in 6-ounce doses twice a day.

Pain should be combated as laid down under that heading.

Cause of chronic hepatitis.—It may result from an acute attack, or it may be brought about by continued excess of food, especially grain and inactivity; both conditions rarely enjoyed by working elephants; hence possible reason of rarity of the disease.

Symptoms.—Drowsiness, sluggishness, poor appetite, dry mouth, thirst, irregularity of the bowels, constipation intermitting with diarrhœa, often pale or dark coloured offensive dung, and frequent passage of wind.

Treatment.—As only likely to be met with in pampered highly fed animals, the diet must be reduced as regards quantity; all grain should be stopped and regular walking exercise daily, the bowels kept regular by administration of laxatives (Appendix 23 to 28). Chloride of ammonia in $\frac{1}{2}$ -ounce doses twice or thrice daily will do good.

Hydatids.

This is a cystic or bladder-like condition met with in various organs and tissues, but more usually in the liver, and represents the immature stage of a tape-worm, which in its mature condition inhabits the bowels of dogs, wolves, and jackals. Its cycle of existence is as follows.

To begin with the egg. This is passed in the fœces of one of the above animals and may gain entrance to the alimentary canal of an elephant by its eating pasturage, &c., contaminated with their droppings. The egg, having once gained entrance to the stomach of the elephant, hatches and liberates an embryo, which displays a desire to migrate, passing through the walls of the stomach, by the aid of six hooklets with which it is provided, to some suitable spot, most frequently the liver. Having found a suitable resting place it casts these hooklets and becomes invested with a fibrous capsule or wall. At this stage it is known as a hydatid cyst.

The hydatid cyst when fully developed consists of a wall with fluid contents, and within it other smaller cysts or bladders are developed, and within these again others may form to a third and fourth generation. These so-called daughter and grand-daughter cysts contain fluid and embryo tape-worms, which are called at this stage "scolices." The scolices consist of a head identical

with the adult tape-worm, a constriction separating it from the body, and a pedicle or foot which is attached at some stage to the wall of the cyst, but which frequently gives way setting the "scolex" free.

The scolex cannot further develop in the elephant. The hydatid cyst thus affords a haven for the propagation of the species which can only develop to the stage of "scolices." In doing this it increases in size often to an enormous degree. In order to complete the cycle of the creature's existence the "scolices" must find their way into the stomach of a dog or kindred animal, which it usually does by this animal eating the organs or flesh of a creature infested with hydatids, the sheep perhaps being the most frequent source.

The scolex having reached the canine stomach becomes endowed with renewed vitality and develops into a mature tape-worm.

The mature worm consists of a head furnished with four suckers and two rows of hooklets, and three body segments, the last of which is provided with reproductory organs.

This worm is commonly seen voided with the excreta of dogs and measures about $\frac{3}{4}$ inch in length. The adult worm produces numerous eggs, which are also voided with the dog's excreta.

It will be seen from the above that, if the ova of the tape-worm gains access to the canine stomach, no tape-worm can result, since it must of a necessity pass through the system of a sheep or kindred animal and pass through the stage of hydatid cyst.

In the same way should a scolex find its way into the stomach of an elephant, no hydatid cyst will result, since the scolex must of necessity pass through the system of a canine animal before again arriving at this stage.

Elephants therefore cannot directly communicate the parasite to one another but only indirectly through the media of dogs, wolves, and jackals.

The dangers of hydatid cyst are—

- (a) it may increase and rupture;
- (b) it may suppurate and become an abscess;
- (c) on the other hand it may rarely be absorbed and disappear.

Treatment: Preventive.—It follows from the above that man-houls should not be allowed to keep dogs about elephant standings and, should dogs' droppings about the standings be discovered, they should be collected, disinfected with carbolic powder, and burnt.

When diseased liver and lungs are discovered after death they should be treated with carbolic powder and burnt.

CHAPTER XIII.

THE EYE—OPHTHALMIA—INFLAMMATION OF THE CORNEA—ULCERATION OF THE CORNEA—OPACITY OF THE CORNEA—STAPHYLOMA—CATARACT.

The eye.

It is a matter of common remark amongst those who have much to do with elephants that a large percentage of them have blemished eyes. Major Hawkes notes, of a batch of 27 elephants examined, that one was totally blind, two nearly so, two blind in one eye, one had cataract in both eyes, and three had partial opacity of cornea in both eyes. I think, if we give the subject a little consideration the cause of this high percentage will be readily apparent.

The eye of the elephant is as delicate and sensitive as our own, and the preservation of sight is a blessing to the animal and an advantage to the owner; yet mahouts are allowed (through ignorance of owners or those in charge) to inflict intense suffering on these creatures, by blowing powdered glass, powders containing ingredients such as lunar caustic, blue-stone, camphor, &c., into their eyes, to remove so-called films, or to treat the eyes with mixtures (applied unsparingly) containing other irritating ingredients in uncertain quantities, such as chillies, ginger, quicklime, preparations of mercury. When such delicate organs are subjected to treatment such as described, it is not surprising that we find so many elephants whose vision is permanently impaired, or totally lost.

It should be made clear to all elephant attendants that any treatment of the eyes carried out by them will result in their immediate dismissal. Captain Forsyth, a careful observer and sympathetic master, remarks: "The eyes of the elephant are extremely delicate and appear to possess, in an unusual degree, a sympathetic connection with the digestive organs. Nearly every indisposition of the animal is accompanied by a clouding or suffusion of the eyes. Few elephants that have been long caught, especially if in the hands of natives, have perfect eyes." Note the remark "especially if in the hands of natives." Mahouts are everlastingly tinkering with their elephants; if not treating their eyes, they are treating them for some other supposed ailment. This amateur doctoring by them is a curse in elephant establishments. If more attention was given to

seeing that these men take their animals to good grazing grounds, that they give them their salt, flour, or grain ration, that they are washed and groomed, and not tethered in the sun or overworked, the elephants would keep in better health.

In the human subject, the eyes are often affected in general bad health. In fact Nettleship remarks that "Ulcers of the cornea are "so often a sign of bad health that we ought never to neglect such "means as may be called for to improve the general condition." (*Diseases of the eye*, page 32). There are very many ailments also in which changes of the eye occur as part of a general disease.

From what has been said it will be admitted that the treatment of eye diseases should not at any rate be entrusted to mahouts. What I particularly desire to impress on those who have charge of elephants is, the importance of not leaving the treatment of the animals in the hands of the attendants. Remember that affections of the eye often depend on more than local causes; endeavour to ascertain them, and, if found to be not purely local, attention must be paid not only to treating the eyes, but to the general state of the health. So important is this subject, that Macnamara, writing of ulceration of the cornea in the human subject, says: "In "most cases, instances of ulceration (excepting traumatic cases, or "those depending on conjunctivitis), the patient's general health will "be found at fault; in no affection of the eye is it more necessary "to attack the disease by improving the assimilative and nutritive "functions of the body, and as a general rule a tonic and supporting "plan of treatment is demanded. Iron and quinine, good food, cleanliness, and fresh air are the fundamental requisites for the cure of "almost all instances of ulceration of the cornea, whether they be of "the sthenic or asthenic type. One frequently sees cases of ulceration of the cornea which resist all treatment, but which rapidly improve if the patient is sent to the sea-side, or, still better, for a "voyage to sea." (*Diseases of the eye*, page 209.) I have quoted this at length, as it has such a practical bearing with regard to elephants, except perhaps the change to the sea-side, or a voyage; but a change to their jungles, and a free life for a time, will prove as beneficial to them as a change to the sea-side for a human being.

Certain precautions are necessary in the treatment of diseases of the eye. Nitrate of silver (lunar caustic), and sulphate of copper (blue-stone) should never be employed in the solid form as irreparable damage may result from the application of such strong caustics. If it is desired to employ them, very weak solutions only should be used. Absolute cleanliness is imperative: attendants dressing eyes with filthy hands and with rags still more filthy should not be tolerated. For the purpose of wiping the eye, there is nothing better than old

soft linen, or lint, which should be cut into small pieces and used as required. After use, the soiled pieces should be buried or burned, in order that flies should not rest on them and thus, if an affection be contagious, carry it to other animals. In fact it is a sound rule never to use pieces of lint, cloth, or sponges a second time. Natives have no idea of the importance of cleanliness in these diseases, and will wipe the eyes with filthy rags, will even drop them on the ground, and use them immediately after.

Elephants are often unusually nervous when their eyes are sore. When it is desired to examine the eyes, the keeper should always be present, the animal's attention diverted as much as possible by feeding him with some favourite food. The medicine must be made up and the mahout given careful instructions how to use it; a responsible person should be present to see the eye dressed.

Elephants with impaired vision or those whose sight is lost should be approached with great caution; they should be spoken to and given the *wind*, otherwise if approached quietly and the wind be not in their favour, even a quiet creature might through sudden fear cause serious damage. It is almost useless for a stranger to try and dress an elephant's eyes; the keeper alone is generally the only person who can do this.

Elephants will not as a rule permit much handling of their eyes as on the least interference they bring the nictitating membrane into play. The best thing is to get as good a view as possible without touching. When examining an eye the attention may be attracted by some one on the opposite side.

Considerable experience has proved to me that with patience and care excellent results can be obtained by treatment.

During the hot season, if elephants are tethered in the glare of the sun, it is a good plan to cover the forehead and eyes with a cloth frequently wetted, or a shade.

The eye in health.—The eye of the elephant resembles that of other animals. The visible portion consists of a transparent convex disc like a watch glass, called the cornea, behind which is the coloured portion of the eye (iris), which is usually brown, and centrally the pupil, which is jet black and round.

The eyelids furnished with eyelashes blink every few seconds and a slight watery discharge flows over the cheek. The diseases do not vary from those in other animals.

The following departures from the above indicate present or past disease, namely,—

- (a) frequent blinking;
- (b) abnormal discharge, either watery or turbid;

- (c) haziness or opalescence of the pupil ;
- (d) opalescence of the cornea ;
- (e) undue redness seen when the lids are separated ;
- (f) blindness, partial or complete.

Ophthalmia, or sore-eyes.

Causes.—Undue exposure to the glare of the sun, irritation from cold winds, smoke, dust, grass seeds, &c., and injury from bites of insects, blows, or abrasions, eating to excess the leaves, boughs of the peepul (*Ficus religiosa, nyaungbin*), contagion from another animal.

The condition may affect one or both eyes.

Symptoms.—When lids are separated, excessive redness, swollen eyelids, frequent blinking, and a tendency to keep the eyes closed, increased secretion (at first watery, later turbid), obvious pain and discomfort.

Treatment: Local.—Protect the animal as much as possible from strong light, put a shade on to exclude dust and flies ; these can be made with a dark cloth, Chinese matting painted green, plantain leaves. I have never found an elephant object to such shades.

For the relief of pain hot fomentations frequently applied, to which may be added extract of belladonna 1 to 1½ drachms to a pint of water (Appendix 94), or the extract alone rubbed down in glycerine (Appendix 95), may be smeared round the eye. As the discharges run over the cheek they may produce soreness, and to prevent this the parts below the eye should be smeared with sweet oil or vaseline. Eye washes (Appendix 89 to 93).

General.—Consists of plenty of good food and tonics (Appendix Nos. 39 to 46).

Inflammation of the cornea.

The cornea is the transparent disc like a watch glass in front of the eye, through which the colour of the eye and pupil can be seen. In health it is perfectly transparent and its surface smooth and glistening, so that it reflects objects like a mirror.

Causes.—A low state of health as in advanced debility, blows, injuries, or wounds of the cornea caused by the entrance of foreign bodies, or abrasions, such as might occur when moving through jungle.

Symptoms.—The same as in ophthalmia, with the addition of dimness, loss of polish and transparency ; the cornea may appear

like ground glass or be quite milky ; this cloudiness is due to infiltration and exudation into the substance of the cornea and is not due to the growth of a film over it as is frequently supposed ; hence the futility and cruelty of blowing in such materials as powdered glass, lunar caustic, &c., for its removal.

Treatment.—Same as in ophthalmia.

Ulceration of the cornea.

Ulcers may occur in this structure as in other parts, and by a careful scrutiny will be recognized by the presence of a pit or lack of substance on the surface ; these may be pin point, but are usually larger ; at the particular spot the reflection of objects is found to be lost. Under proper treatment this should resolve and the cornea in course of time regain its original transparency, but it often happens that a scar persists, shown by an opacity which may be permanent.

The symptoms leading to a suspicion of the presence of ulceration are similar to those manifested in ophthalmia and the treatment identical. When the ulcer has healed and an opacity is left, calomel on a camel's hair brush should be flicked into the eye once daily to hasten absorption (Appendix No. 97) ; or a small portion (about size of a split pea or hemp seed) of yellow oxide of mercury ointment (No. 96) inserted under the lid once daily may prove beneficial.

Opacity of the cornea.

Is sometimes seen in old age ; it is generally observed around the margin of the cornea, appearing as a faint milky ring.

Treatment.—*Nil.*

Staphyloma, or the "mothea beenj" of natives of India.

Is applied to a bulging resembling a small blister on the surface of the cornea.

Causes.—Ulceration. Occasionally an ulcer eats its way deeply into the substance of the cornea which may become so thinned that the pressure of fluid within the eye bulges the floor of the ulcer forwards.

Symptoms.—In addition to the bulging, which is a sequel to an ulcer, there is impaired vision ; owing to movements of the lids this blister may rupture and fluid from the eye escape, but this is never-

theless a remediable condition and the eye may regain its usual appearance and function with proper care.

Treatment.—As already laid down in ophthalmia. It is necessary, whether pain be present or absent, to smear extract of belladonna around the eye.

Cataract.

This term is applied to an opacity of the lens (which is a transparent body situated behind the pupil and invisible) and not as is often supposed to opacity of the cornea, the condition last referred to.

Causes.—Blows on the eye, and changes consequent upon old age.

Symptoms.—There is partial or complete blindness, attraction to which is drawn by peculiar behaviour of the animal. If the eye is carefully inspected in these cases, the only change likely to be seen is an opalescence or haziness of the pupil, replacing the jet black normal appearance. They generally develop slowly (months or even years), but, when due to severe blows or injuries of the eye, may appear in a few days. They tend to culminate in complete blindness. As a rule the cornea is quite clear, but, should there be opacity, it is independent of the cataract.

Treatment.—*Nil.*

CHAPTER XIV.

THE TEMPORAL GLANDS—CONGESTION OF THE TEMPORAL GLANDS OR "MUSTH"—INFLAMMATION OF TEMPORAL GLANDS.

The temporal glands.

THESE well-known glands called *kapool* by natives of India are two in number, and are situated one on each side, about midway between the eye and ear-hole. Their ducts open on the skin in this region. The glands are usually inactive. They are analogous to the glands in deer, which open into pits seen under the eyes and to the gland on the back of the head of camels.

Congestion of the temporal glands or "musth."

Male elephants and very rarely females, on attaining maturity, are subject to peculiar periodical paroxysms of excitement, which seem to have some connection with the sexual functions to which the name "*musth*" is applied by the natives of India and *mon-kya-thi* (မုန်ကျဆင့်) by the Burmans. It is probably analogous to the "rut" in deer.

Causes.—It occurs both in wild and tame animals and in the latter is more often met with in highly fed, pampered beasts that receive insufficient exercise. It occurs most frequently in the cold season and may perhaps be due to ungratified sexual desire in some cases, but not always so, since the society of a female by no means always quells or even pacifies animals in *musth*. At other times an animal in *musth* undoubtedly seeks a mate of the opposite sex.

Symptoms.—"Musth" occurs frequently in some beasts, seldom in others, so that the intervals are variable in different animals, and in the same manner so are the symptoms. More or less excitement is usual, but on the other hand some elephants become dull and morose. The behaviour changes, shown by disobedience to commands, trying to break away, or showing violence to man or destructive tendencies, or being altogether out of sorts. The temples become puffy, due to swelling of the temporal glands which lie beneath the skin, and at this stage is called by many mahouts *Kherr Musth*; later an oily discharge exudes from the hole or duct of

over the gland, which is then called *musth* by the natives. When "musth" is established there is often a partial retention of urine, the water dribbling away. As soon, however, as the urine is passed freely the natives consider the dangerous stage over, irrespective of the amount of discharge from the glands.

The attack may last a few days, weeks, or months.

Treatment.—On the first signs being evinced, the animal should be speedily removed from the vicinity of habitations and very securely fettered (extra chains being employed). Should he escape or show violence before being fettered, if possible give a dose of opium or ganja mixed up with plantains, jaggery, or sweetened rice. It is as well to bring in the aid of a couple of heavy tuskers, if very troublesome, to assist in effecting one's object. Once fettered, a female should be tethered not far from him, but in case this enrages him, she must be removed. Foresters generally have some females loose with males when out grazing as a precaution, lest an animal becoming *musth* should stray away in search of such companionship and be lost as they occasionally are.

Grain must be entirely withheld, and green food only given in small quantities for several days. To calm the excitement, drugs are generally necessary, and the best of these in the early stage is a strong purgative (Appendix 29 to 38), also in the early stages opium, or ganja 4 to 6 drachms, given mixed with boiled rice, plantains, or jaggery, or—

Camphor	...	...	...	...	3 drachms.
Opium	...	...	...	...	2 drachms.

Twice a day for two days, or—

Wheat flour	...	...	...	...	8 pounds.
Onions	...	...	...	...	8 pounds.
Sugar	...	...	...	...	8 pounds.
Ghee	...	...	...	...	4 pounds.

Mix and make into pills the size of an orange, and give one night and morning till the whole is taken (*Hawkes*). I can most strongly recommend the use of bromide of potash in doses from $\frac{1}{2}$ to $\frac{3}{4}$ of an ounce once or even twice daily. If this drug is given in the early stages, so much the better. I have records of most troublesome animals, that had always to be securely fettered during "musth," under this treatment carry on their work as usual.

Inflammation of the temporal glands.

Causes.—Sometimes the unusual congestion of these glands during the period of "musth" runs on to inflammation, especially when *musth* has been prolonged.

Symptoms.—The temples become hot, tender, painful, and much swollen, and even an abscess may form.

Treatment.—At first a smart purge and hot fomentations ; later, if matter forms, it should be evacuated by incision. The skin below must be smeared with oil or vaseline to prevent the discharges irritating the skin and making it sore.

CHAPTER XV.

THE SKIN—INFLAMMATION OF THE SKIN—ABRASIONS—WOUNDS—ULCERS AND SPECIAL SORES—CRACKED SOLE—CRACKED HEELS—ULCERATION OF FOREHEAD—ULCERATION OF THE EAR—ULCERATION OF THE TAIL—ABSCCESS (PURULENT)—ABSCCESS IN THE FOOT—ABSCCESS (SEROUS)—BOILS—WARTY GROWTHS AROUND THE NAILS—INGROWING AND OVERGROWN NAILS—MOISTURE AROUND AND UNDER THE NAILS—ECZEMA—URTICARIA (NETTLE-RASH)—PITYRIASIS (SCURF)—EXTERNAL PARASITES—TENDER FEET—INFLAMMATION OF THE FEET.

The skin.

THE functions of the skin are many. In the first place it affords a protective covering to the tissues which build up the structure of the body.

As before remarked, though the skin is very thick, it is extremely sensitive. It is owing to this thickness that abscesses do not readily come to a head and burst.

In health the temperature of the skin is of a uniformly even warmth ; it is free from scurf, dark in colour, and pliable to the touch. Embedded within its substance are various organs with special functions to perform.

(1) *Hairs*.—These are bristly in character, stiff to the touch, and firmly rooted, and are more abundant in certain localities. In the adult they are numerous on the forehead, lower lip, upper lip, orifices of the ears, and end of the tail. On the latter they are larger and stiffer in character, and grow from the anterior and posterior borders and tip, extending much higher up on the anterior, where they are usually longer. Young elephants usually have much more hair about them than adults.

(2) *Nails* are horny in appearance, of a yellowish horn colour, smooth, and, when clean, glossy. They contribute towards the formation of the foot-pad, they are firmly embedded, not tender, and there is usually a slight moist exudation of an oily character around the tops, readily discovered by throwing a little dust over that region ; they should not readily split or break.

(3) *Sweat glands*.—Small glands are situated in the skin, whose function it is to secrete sweat, which by evaporation assists in regulating an equable temperature of the body. This secretion, however, is slight, and best seen after removal of pack-gear.

(4) *Nerves*.—These terminate in special organs in the skin, by whose agency the animal is able to appreciate various sensations, such as touch, cold, heat, and pain.

Any departures from the above may point to disease, namely,—

- (a) Hairs may be unduly soft, easily removed, or are often shed, especially those of the tail.
- (b) Nails may be soft, cracked or broken, overgrown, rough or rugged, and an excessive discharge may be seen around or beneath them.
- (c) In parts there may be local tenderness.
- (d) Scurfiness, harshness, and unusual dryness.
- (e) Temperature may be uneven, or variable.
- (f) Cracks, sores, or eruptions.
- (g) Swellings, which may be *localized* such as in abscesses, or *diffused* as in dropsies, when the skin is distended, shown by a partial or complete effacement of the wrinkles, and doughiness.
- (h) Parasites, as ticks, lice, &c.

Inflammation of the skin.

The skin in common with other structures is liable to become congested and inflamed. This may merely be superficial, affecting the surface of the skin, called abrasion, or deep affecting the deeper layers, or subjacent tissues as abscess, and both will necessarily vary in extent.

Abrasions, or galls.

Consist of local breaches of the surface, due to friction.

Causes.—Most commonly seen as a result of chafing, of ill fitting gear, gear ropes and chains, or fettering, or tethering chains, or dirt.

Severe galls may be met with on the legs, especially amongst recently captured animals. The raw hide thongs by which the legs are tied together, are often drawn too tight, the parts swell, and the thongs cut deep into the flesh. These animals, in trying to get free, strain and twist themselves about to such an extent as to cause nasty cuts with ropes and chains. They are sometimes due to carelessness. Yards of chain are coiled round a leg and the elephant set free to graze; if not removed regularly, or changed occasionally to another limb, dirt, sand, work in, cause friction and soreness of the skin, which, if not attended to, may lead to nasty sores.

The irritation which has been sufficient to produce an abrasion is often sufficient to produce engorgement of the deeper lying parts, which will be found swollen, hot, and tender. This condition is seen usually on the back and is the result of a badly adjusted or heavy load.

The abraded surface is frequently very much smaller than the underlying swelling of the tissues. If this is not immediately attended to, the animal entirely rested, and the abrasion carefully dressed, there is every likelihood of the swelling increasing and becoming an abscess, or the abraded surface, which really represents superficial destruction of the skin, may die or slough so as to incorporate the whole thickness of the skin (forming the condition familiarly known in horses as "sitfast"), the slough on separating leaving a hole.

Treatment: Preventive.—Consists of cleanliness both of the skin and the gear with appliances. The gear should always be the best made, as cheap materials are notoriously provocative of chafes and galls. It should always be carefully fitted and adjusted and frequent inspection of the gear and appliances during work and readjustment of loads, gear, when necessary must be enforced. After work, when the gear is removed, careful inspection for chafes should be instituted. Mahouts from malice sometimes place foreign bodies, such as stones, under the guddela, with the intention of laying up an animal, and as before remarked under pack-gear. Some mahouts from ignorance or thoughtlessness stow away spare chains, into the space of the guddee, which when placed on the guddela forms a convenient receptacle. This is a serious malpractice. To sum up, all preventive treatment consists in thorough supervision.

Curative.—Rest so far as it will remove the offending agent is imperative, by which I mean should there be a crupper gall, and he can be worked without the crupper, no harm need arise. The raw surface, however small or apparently trifling, must be at once attended to and dusting powders, ointment, applied (*see Appendix 64 to 69 and 125 to 129*).

Should the abrasion be situated on a swollen base, cold applications must be frequently applied night and day or in the form of cooling lotions (*see Appendix 103 to 106*) to try and check the condition running on to abscess, but should there be no reduction of heat, pain, and swelling within three days, hot continuous fomentations must be substituted to hasten the formation of matter which it may be taken is certain to be forming. These hot fomentations will also assist in hastening the detachment of any dead tissues should there be sloughing. Those parts where fetters, &c., are applied for tethering purposes are liable to chafes and galls; when this occurs, they must be placed on other limbs.

In recently captured elephants, thongs and ropes must be tied if necessary in a new situation or discarded, and extra fetters and tethering chains put on for security.

In these cases; owing to the danger of approaching the animal, the sores are neglected and maggots gain access; they must be treated as laid down under wounds.

On service it is sometimes necessary to work animals with slight galls. In such cases the injured parts may be relieved by removal of stuffing from the guddee to form a hollow large enough to take in and protect the part from further injury.

NOTE.—Timely warning here must be offered, which must be applied to all diseases of the skin, abrasions, ulcers, abscesses, wounds, including sprains and lameness from any cause. The practice, as I have frequently observed, is to put animals into work as soon as ever the diseased condition has been repaired; this is a serious maplactice. The tender new skin which has re-covered an ulcerated surface, requires several days, if not weeks to acquire sufficient durability to tolerate conditions which may be applied to a healthy skin in the way of friction and pressure. The same applies to all tissues which have newly replaced diseased ones. An animal therefore should be kept out of work from a week to a month, depending on the severity of the injury after he appears to be thoroughly convalescent. I am convinced, if attention is paid to this matter it will be found more economical in the long run.

Wounds.

Definition.—A wound is a solution of continuity of soft structures, generally induced by violence from without, but at times from within, as is the case when a broken bone pierces the tissues.

Causes.—In elephants, fighting is one of the chief causes of serious wounds. Severe falls and other accidents may similarly occasion them.

Varieties of wounds.—For convenience of description, they have been divided into several classes. It is, however, only necessary to describe those most likely to be met with, namely,—

- (1) *Incised wounds* such as are inflicted with clean cutting instruments, knife (*da*). These wounds bleed freely from their whole surface, and generally heal rapidly.
- (2) *Punctured*, in which the depth is much greater than its superficial extent. *Example*: stabs, wounds from spikes, bamboos. These wounds are generally

dangerous owing to the possibility of important organs being injured and the difficulty in thoroughly cleansing them. Any poison which may have gained entry lurk in the wound and may set up various serious diseases.

- (3) *Lacerated* wounds, in which the tissues are torn; they do not bleed so freely as incised and punctured wounds, for the simple reason that the coats of torn vessels contract more readily than is the case when they are cut clean across.
- (4) *Contused-lacerated*, in which, in addition to a wound, there is much bruising of the surrounding parts. Such injuries do not heal very rapidly owing to the mechanical injury the tissues may have suffered, which may be so severe as to lead to their death (*Slough*). There is a tendency to formation of matter. *Example*: After a fight, as the defeated animal retires, he is often followed up by his opponent, who freely butts his hinder part; should he happen to be in possession of blunt, short tusks, a contused-lacerated wound is likely to be the result.
- (5) *Poisoned wounds*.—Bites of venomous snakes, stings of insects.

Treatment of wounds in general.—(a) Arrest the bleeding.

(b) Search for, and remove foreign bodies, such as pieces of glass, thorns, splinters, and cleanse wound.

(c) If possible secure edges of wound in apposition.

(d) Apply dressings with a view to exclusion of air, flies, dust, also to ensure cleanliness and promote healing.

(a) *Arrest of bleeding*.—Bleeding may arise from an artery, a vein, or minute vessels called capillaries. The methods employed are—

- (a) *Torsion*: seize the end of the vessel when seen with forceps, twist three or four times, and let go; only applied to small vessels about the calibre of a packing needle or less.
- (b) *Pressure*, as with pad and firm bandage, only employed for slowly oozing blood.
- (c) *Application of cold*, such as ice; only applied for trifling oozing.
- (d) *Application of heat*, such as hot iron, or water at a temperature which the hand will barely bear, about 110° F.
- (e) *Drugs*: perchloride of iron, gallic, and tannic acids.

(f) *Ligature*, tying the vessel. The end of the vessel is seized with forceps and a piece of silk, catgut, or fishing gut (previously disinfected) tied round it and secured. The thread is then cut off, leaving ends from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length. If the vessel be a vein, both ends must be secured. This is the method most certain and can be applied to vessels of any size.

Blood from an artery may be recognized by its red colour, rapid flow, and the blood spurting out in jets; while that from a vein is darker and the flow continuous. In capillary bleeding there is a general oozing over the wounded surface. Capillary bleeding is the least serious.

(b) *Removal of foreign bodies*.—Splinters of wood, pieces of glass, and other bodies often remain in a wound; search should always be made for these and, if found, removal may be effected by means of the fingers, or with the aid of forceps. Much handling and probing of a wound is not necessary. Dirt, gravel, can best be removed by the free use of warm water. As a rule no raw surface should be wiped or rubbed. To cleanse the wound, small pieces of clean old linen should be employed. This may be carried out by merely dipping clean cloths in boiled water (which should be luke-warm when used), or in a weak solution of carbolic acid (1 to 60), phenyle (1 to 60), or 2 grains of permanganate of potash to the pint. Appendix Nos. 114 to 120, each cloth should be gently squeezed above the wound so as to allow the water to trickle over it, or a rubber tube may be attached to a funnel, or a large tin-pot with a spout. The solution can then be directed all over the wounded surface so as to thoroughly cleanse it. A large syringe also answers the purpose. Great force is unnecessary.

As a precaution, when an elephant will permit the operation, in cases where punctured wounds are found on the limbs, after the offending agent is withdrawn, I would strongly recommend that the wound be enlarged with the knife, carefully inspected again for foreign bodies, and then treated with carbolic acid (1 in 3), which must be carefully rubbed into the deepest portions, but this method must not be applied wherever there is any likelihood of any internal organ being touched; here it is best to cleanse the wound with carbolic lotion (1 in 40) and dress and await developments.

Generally speaking, the less wounds are handled and interfered with the quicker they heal. Mahouts are fond of treasuring up every piece of filthy rag for future use, and they are for ever rubbing, or wiping raw surfaces with them, and not infrequently use

them for plugging wounds of the back. There is only one way of preventing this, namely, to make a point of burning all pieces of cloth, dressings, after use ; and after all, this is not much trouble.

(c) Whenever a wound is found gaping, it is, where possible, desirable to bring the edges into contact ; and the handiest method I can advise and one least calculated to be resented by the patient is to apply strips of the best resin plaster ; each strip must be passed sharply backwards and forwards over hot embers to ensure perfect adhesion. Hair should be removed.

To apply it cut two strips of plaster about 2 feet in length and of width according to length of wound, say, from 1 inch to 3 inches, shaped as Nos. 1 and 2 ; pass No. 1 through the window C of No. 2 and adjust before sticking down, so that the length of one piece overlies the length of the other. Having done this, stick A end of No. 1 on one side of the wound and the B end of No. 2 on the other, leaving the B end of No. 1 and the A end of No. 2 free. Exert traction on both these free ends, which will approximate the edges of the wound. Having performed this, stick the ends down. In case the above is not clearly expressed, cut strips out of paper and practice the method. This plan answers well in some wounds.

Another method may be tried as follows : Suturing or sewing. This is a less easy matter in the case of elephants, owing to the thickness of the hide and the strength of the muscle beneath the skin. It is certainly worth trying in recent incised wounds. Ordinary stitches do not as a rule hold well. I would therefore recommend the use of some new suture buttons suggested by Mr. Pugh, and manufactured by Messrs. Arnold and Sons, West Smithfield, London. The button is to be had in various sizes and in two shapes, oval and round. It is made of aluminium and is therefore light ; there is a hole in the centre for passage of the wire, and on each side of the hole is a clip, around which the wire can be twisted in a figure of eight. The advantages claimed are : its simplicity and lightness, it prevents cutting or tearing of the edges of the wound, and lastly it is easily rendered aseptic for future use by boiling. Surgical needles, medium curve, with extra sharp edges are required ; they should also be made in order to carry stout silver or lead wire. A needle holder is also most necessary to facilitate the easy passage of the needle through the thick skin.

In stitching elephant wounds, separate stitches are the best. It is better to make the first stitch at the centre of the wound. To make a stitch, the needle is passed through the skin on one side of the wound from without inwards ; then through the other

edge from within outwards; the ends of the wire are to be taken and drawn in gently so as to bring the edges of the wound together; when this has been effected, the ends of the wire are to be twisted securely. The employment of buttons will be preferable. Stitches should not be too close: a space of at least $1\frac{1}{4}$ inches to $1\frac{1}{2}$ inches should be allowed. The most dependent part of the wound must be left open in order to permit free escape of all discharges. The lips of large gaping wounds must not be forcibly dragged together as the stitches will cause much pain and are almost certain to give way. Again, stitches should not be made too near the edges; they should be placed far enough from them and of sufficient depth to ensure a good hold.

(d) *Dress the wound.*—The object of dressing is to keep the wound clean, to prevent exposure to the air, prevent entrance of dust, flies, and to provide a means of applying certain medicaments (see Appendix 121, 125 to 129 and 64 to 69).

Poisoned wounds.—These include snake-bite, stings of insects, and wounds inflicted by tigers.

In the case of hornet stings, apply dilute ammonia.

Snake-bite.—I have heard of three cases of elephants said to have been bitten by cobras; no case proved fatal, though one was reported to have been in a precarious condition for twenty-four hours.

When elephants die suddenly Burman mahouts invariably report the cause of death as due to snake-bite. I think I am correct in stating that quite one half of the deaths amongst elephants in this province is attributed to snake-bite. I have never seen a case proved nor have I met anyone who has. I would therefore warn owners against believing such reports without ample proof. The poisonous snakes likely to be met with in heavy jungle are—

- (1) Hamadryad (ခန်း၊ ခန်းဖုတ်), rare.
- (2) Cobra (ခွေထောင်), rare.
- (3) Green pit viper (ခွေပိတ်), a common tree viper, the bite of which, however, is very rarely fatal even to human beings.

In open country—

- (4) Russell's viper (ခွေပိတ်), common.
- (5) Cobra (ခွေထောင်), common.
- (6) Banded krait (ခန်းထောင်ကြား), common.
- (7) Indian krait, rare.

Tiger-wounds.—Elephants are occasionally attacked and mauled, and the wounds inflicted are peculiarly poisonous, but such wounds must be treated on principles already laid down, that is, thorough cleansing, and application of some caustic such as carbolic acid 1-3.

In any wound where much pain is evinced the following may be employed to allay this—

Acetate of lead	...	...	...	4 grains.
Acetate of morphia	...	...	...	2 grains.
Water	...	...	...	2 ounces.

Owing to the neglect and improper treatment of wounds, elephants are constantly incapacitated for work for months, which is absurd. I know from experience that with care and attention wounds in elephants, though certainly not disposed to heal as rapidly as in most other creatures, will heal in about one-fourth the time it takes a mahout to cure them.

Owners of elephants, and especially firms who have European Assistants, should insist that elephants placed in their charge shall not be treated (except under their personal direction) by mahouts.

Ulcers or sores.

An ulcer is the sore or wound left after the loss by decay or destruction of some superficial part of the body, whether skin or mucous membrane—(*Mansell-Moullin*).

Causes.—Neglected abrasions or wounds and eruptions, such as eczema.

Characters.—When a sore is healthy it presents a reddish (florid) colour and in a day or two small points (about the size of millet seeds), called granulations, beset the floor; these should not bleed very readily on being touched and the wound should yield a thickish yellow inoffensive discharge; the edges should be soft, not raised nor undermined.

Treatment.—(1) Such a sore requires any of the following:—dusting with powdered boracic acid, or equal parts of boracic acid and iodoform, or equal parts of oxide of zinc and starch (Appendix 64 to 69), and at each time of dressing the sore must be cleansed with some such lotion as carbolic acid or phenyle (1 in 60), perchloride of mercury 5 grains to the pint (1 in 2,000), or permanganate of potash 2—4 grains to the pint, or thymol 10 grains to the pint of hot water, (1—1,000).

(2) When the surface is dark red and the parts hot and swollen and there are large projecting engorged granulations (proud flesh), bleeding on the slightest touch, and the discharge thin or bloody, the following is the treatment:—Apply lead lotion (*see* Appendix 105 and 106), or equal parts of powdered alum and starch, or acetate of lead and starch, or solutions of sulphate of copper 10—12 grains to the ounce. Sulphate of zinc 10 grains to the ounce, once or twice daily till the surface assumes the appearances in a healthy sore (also *see* Appendix 61 to

(3) If the sore has no granulations, but shows a smooth shrunken surface and is pale, and discharges a thin watery fluid, apply the following treatment:—Resin ointment (Appendix No. 131) or nitrate of mercury ointment, Friar's balsam, or one of the following lotions (*see* Appendix Nos. 109 to 113). Care must be taken to improve the quality and quantity of the food. This class of wound is most often met with in aged or debilitated animals.

In a neglected sore there may be maggots which may be actually seen, or suspected by applying the nose close to the wound, when there is usually a foetid odour, and a dirty offensive thin discharge. When seen they must be removed with forceps; if only a small opening exists, it should be opened up and the maggots cleared out, and subsequently the wound dressed with carbolic acid lotion (1 in 40). Some elephants will not permit much handling, others insist on removing dressings, blowing in dirt, &c.; and when wounds exist in such animals, to avoid the entrance of flies, Dikamale ointment (the resin from the *Gardenia lucida*), a common bazaar drug (Appendix No. 130), or powdered camphor dissolved in spirit and mixed with sweet-oil, or equal parts of turpentine and sweet-oil, should be very frequently applied. The abovenamed drugs will also remove maggots from wounds.

When dressing wounds the soiled dressings when adherent must be thoroughly soaked with solution of carbolic acid or phenyle (1 in 60), and gently withdrawn instead of being pulled off. Apart from damaging granulations, the more pain occasioned the more timidity will be aroused in the patient and greater will be the difficulty in future applications.

Ulcers above the foot-pad.—A special form of ulcer is seen sometimes on the feet: timber elephants working much in water frequently get nasty ill-conditioned sores, usually one or two above the nails, and even behind the foot. The first thing observed is a swelling, about the size of a pigeon's egg, hard to the touch, and not painful, if disregarded the centres soften and break down, leaving ugly ulcers, which are troublesome to heal.

Treatment.—If a lump such as described be observed, the animal should not be allowed to work in water. The swelling should be thoroughly painted with liniment of iodine, which, if used two or three times, generally causes the swelling to disappear. If a sore is present, the feet must be kept dry, the ulcer cleaned with carbolic or other lotions; if indolent, the edges should be gently rubbed with blue-stone, or lunar caustic, and dressed with the ordinary wound dressings. In severe cases, in which there is much hardness around the sore and which shows no tendency to heal, the application of a hot iron may do much good, or a blister round the sore may stimu-

Ulcers on the elbows.

Causes.—Animals being frequently made to assume the recumbent posture on hard ground for loading, swelling may result at the points of contact with the ground; if neglected, they may ulcerate, causing nasty troublesome sores. They are not frequently met with here, as generally speaking most people use the *kah* or basket, and the animal is not necessarily required to assume the recumbent posture the packages being handed up. Sanderson's pattern gear is supplied to Government Officers. In an article in the *Veterinary Journal* of November 1882, Nunn treats of these troublesome sores.

Symptoms.—Local swellings in the position of capped elbow in the horse; the swellings are often very painful and tender.

Treatment.—Avoid the cause above mentioned and do not keep an animal in the recumbent position longer than is absolutely necessary. The elephant should be loaded as quickly as possible, and this can be done if those around are made to work instead of talk and argue with the mahout.

The animal should be tethered on soft ground so that he may lie down; fomentations and afterwards painting with liniment of iodine, (Appendix 137), or applying a blister, may reduce the swellings. If ulcerated, treat as laid down under that heading.

Cracked sole.

This is a condition in which ulceration takes place in the natural cracks, or crevices of the sole. It is a most troublesome affection, and difficult to cure. In some cases proud flesh occurs.

Causes.—Generally affects animals that are always working in water, such as many timber animals have to do; bad sanitation is another cause.

Symptoms.—The affected parts appear sore; there is often a nasty oozing discharge from the cracks. Some animals suffer so much pain that they are disabled, in fact unable to stand.

Treatment.—In this affection cleanliness and keeping the feet dry are all important. While the animal is down, poultices may be applied, bran sprinkled with phenyle, or a little carbolic acid lotion or bran and powdered charcoal poultices are useful (*see* Appendix, page 234). When the feet are cleaned, they may be washed with some mild disinfectant, then dried, and some dry dressing such as equal parts of boracic acid, oxide of zinc, and iodoform should be

employed. A pad of tow should then be applied, and a gunny-bag to keep the tow in place. The foot should then be enveloped in a leather boot, or a boot with wooden sole and leather upper. If there is any tendency to proud flesh, it should be kept down with blue-stone, or some other caustic. The following dressing may also be tried :—

Sulphate of copper	...	...	...	1 part.
Tar	...	...	...	8 parts.

Mix and heat together over a slow fire.

Dry calomel may be introduced into the cracks, or a small quantity of burnt alum. The following recommended by Tuson also makes a convenient dressing :—

Tar	...	...	...	2 parts.
Soft soap	...	...	...	1 part.
Linseed meal sufficient to impart tenacity to the mixture.				

This dressing may be applied when the animal is convalescent, at which period he may be sent out with an attendant, who should take care that the animal does not enter water.

Slym recommends for this affection the following dressing :—

Bark of the jack tree	...	...	A good quantity.
Substance of the palmyra palm trunk	...	...	A good quantity.

Boil with water a good quantity, or so much that after about four hours a gallon or more is left, strain, and while hot add—

Cutch	...	...	...	6 ounces.
Soda	...	...	...	6 ounces.
Wax	...	...	...	8 ounces.
Oil	...	...	...	3 quarts.

Make the elephant lie down and apply the above with a piece of cloth, after cleaning the crevices (Appendix No. 133 and 134).

Arsenic may be given internally: either *Liquor arsenicalis* $\frac{1}{2}$ an ounce morning and evening, or arsenic 2 grains morning and evening, for a week or so, after which it should be discontinued for a few days, during which time other tonics should be substituted.

Cracked heels.

This condition is the *sajhan* of the natives of India.

Causes.—Attributed to bad management, as it is seen usually in animals kept on filthy standings, those allowed to stand for days together in slush, and those that have to work timber daily in water. Forsyth attributes it also to constitutional causes and remarks that it is a serious unsoundness owing to its liability to recur every rains.

Symptoms.—Consist of a cracked condition of the foot, usually about the junction of the horny sole and the skin, from which a discharge may issue.

Treatment : Preventive.—Animals that have to work in water should be carefully inspected after work and, on the slightest appearance of any cracking, the matter should be reported and the animal rested or changed to other work.

Curative.—Clean and thoroughly dry standings, if possible, on cement or boarded floors ; on no account should an animal be allowed to enter slush or water ; he should be bathed away from a stream. The affected parts are to be cleansed thoroughly daily with phenyle (1—60), or carbolic acid (1—60), or Condy's fluid 1 ounce to the pint, and the parts dressed with carbolized vaseline or oil, oxide of zinc ointment, or boracic acid ointment, or with powdered boracic acid and iodoform, equal parts, or iodoform, oxide of zinc, and starch, equal parts. If discharge is profuse, acetate of lead 1 drachm to 12 ounces, or sulphate of zinc or copper, 4 or 5 grains to the ounce of water should be applied once daily. The affected parts must be covered with tow and the foot enveloped in sacking ; on recovery the animal must not be worked in water for two or three months.

Ulceration of the forehead.

The skin of the forehead is liable to become tender and sore from constant exposure to a hot sun. Ill-tempered careless drivers are given to a too free use of the goad, inflicting punctured wounds. Injury may also occur to the forehead when not protected, while the animal is engaged in pushing or overthrowing obstacles.

Care must be taken with these cases, as the inflammation is liable to spread to the sinuses of the skull.

Treatment.—If due to exposure, the animal must be given complete rest, kept under shelter, the bowels opened by a smart purge, and cold applications by wet cloths applied (Appendix No. 103 to 106). In some cases hot fomentations afford more relief. When the inflammation subsides, alum lotion, or weak zinc or copper lotion, 3 to 5 grains to the ounce of water, may be applied, or carbolic, iodoform, or oxide of zinc ointment (*see* Appendix Nos. 109, 110, 125, 127, 129).

When lotions are used, care should be taken to see that the cloths are well wrung out to prevent any getting into the eyes, and, as an extra precaution, vaseline, lard, or oil should be freely smeared round the eyes.

In severe cases there may be some ulceration and formation of matter. Such parts must be kept thoroughly clean, the matter given exit, and the injuries carefully protected. Some of these cases

are difficult to cure. If the ulcers are indolent, they may be touched with a little lunar caustic or blue-stone. If the bone be exposed, the surface should be dressed with dilute nitric acid lotion (dilute nitric acid 2 drachms to 8 ounces of water).

Elephants that are much exposed to the sun should be provided with a quilted pad, especially if employed for much pushing work. If a pad is not available, a coating of pipe-clay, chalk, &c., assists in protecting the head from the effects of the sun. The daily application of oil tends to deepen the colour of the skin and the elephant accordingly feels the heat more; but oil is very useful to the attendant, so is indented for.

The skin of the forehead of elephants under Indian mahouts is often tender and sore, owing to the brutal manner in which many of these men employ the goad. The best treatment for maltreatment and carelessness is to place the attendants on half pay during the period their charge is incapacitated from work.

Ulceration of the ear.

This may be seen on the edges of the ear, on the flaps, or in the canal which leads internally.

Causes.—Dirt, debility, or bathing the animal when heated, neglected tears, and wounds. The condition is also met with sometimes in well-conditioned elephants, the tail being affected at the same time, and this has caused me to believe that certain grasses, or even grain food may be affected by a fungus such as 'ergot.' Ergot is a fungus which grows on rye and other grasses, and produces gangrene, or a destructive ulceration of the fingers, toes, and other extremities in human beings. It seems to me possible that this identical fungus or something similar may account for this condition which we see in these animals.

Symptoms.—That form seen on the edges of the ear has a tendency to spread and the parts to become destroyed and thrown off, considerably reducing the size of the flap.

That which is met with on the flap and sometimes extending into the canal, discharges profusely. When the canal itself is attacked there is a danger of the disease extending to the brain.

Treatment.—Is difficult in this situation owing to the perpetual motion of these appendages. The sore surfaces must be kept thoroughly clean and dressed on the lines already mentioned for ulcers.

When the canal is affected, a syringe will be required to keep the parts clean; no force must be employed and the canal must not be plugged. To insure powders reaching the ulcerated surfaces, they should be placed in a small bamboo, which, when insinuated into the orifice, may have its contents gently blown in.

Ulceration of the tail.

Ulceration sometimes attacks the extremity of the tail.

Causes.—General debility, or extreme age.

Symptoms.—The hair is shed and the skin ulcerates for a variable distance up the tail. This destructive process is prone to extend to the deeper tissues, all of which may die and considerable portions of the tail may slough off.

Treatment.—As laid down for ulcers in general.

Abscess.

The term applied to a circumscribed collection of matter (pus) usually occurring in the deeper layers of the skin or tissues beneath it.

Causes.—Irritation and uncleanliness, pricks from thorns, stakes, nails, bruises, uneven pressure from loads, ill-fitting gear; hence it follows that they are most often met with on parts subject to pressure such as the back and sides; they are not infrequently seen in the feet.

Symptoms.—Swelling accompanied by heat, pain, and tenderness. The formation of matter in these animals is a somewhat slower process than in man and many animals, and, owing to the thickness of the skin, the abscess does not readily come to a head and so permit of exit of the contents, but instead it burrows beneath it.

Treatment.—As soon as a swelling about the back after work is noticed, it should be treated as already laid down for this condition under the heading of abrasion. When matter has formed, the only treatment consists in evacuating it; this in itself is a simple process, but the diagnosis of the presence of fluid is frequently a difficult matter as owing to the thickness of the skin fluctuation is not readily obtained. To observe fluctuation place the fingers *firmly* on one side of the swelling and with the fingers of the other hand gently press the tumour; if the swelling be felt to rise and fall under the first hand, it is due to the presence of fluid, and the sensation imparted is what is understood as *fluctuation*; it is as well to try and obtain it in two directions at least. To recognize fluctuation

only requires a little practice, but much skill is necessary to detect matter in small quantity or where it is deeply seated. As already observed, if matter be not liberated, it will burrow and increase the extent of the mischief; hence it is essential to evacuate it as soon as possible after it has formed. A swelling that has shown no sign of reducing and is attended by pain, local heat, and tenderness, and especially if there be any fever present, even if fluctuation be not obtained, a knife should be plunged deeply into it, for it is better to do this when no matter exists than to postpone doing it for some time after it may have accumulated; no harm beyond laying the animal up for a few days can arise from the first contingency, but considerable harm in the latter.

Mahouts are proverbially dilatory in opening an abscess and prefer to leave it, saying that it is not ripe, or too hard, and are therefore responsible for the loss of an animal's service for a much longer period than need be.

Method of procedure in opening an abscess: first of all wash the part thoroughly with some disinfecting solution (*see* Appendix 114 to 120), then plunge a knife deeply into the swelling, *i.e.*, stab it, or better still plunge a fine trocar and canula into it, withdrawing the former; if matter now escapes, make a free incision into the swelling in such a situation as to allow the readiest means of drainage, that is, if on the back incise the lowest portion of the swelling, naturally if the upper portion was opened a pocket would be left in which the discharges would collect. A free incision right through the length of the swelling is in my experience the shortest procedure in the long run. Mahouts if allowed to carry out their own methods will tinker about the business, fail to give free vent to the discharges, and will lay an animal up indefinitely. If in the region of the spine or bony points, the hands or fingers should after disinfection be thrust in and the wound explored for dead pieces of bone (*see* Fig. 33), which may occasionally be found and should be removed, after which the cavity should be cleansed by syringing it out with disinfecting lotions and the wound dressed, and a large piece of lint steeped in some camphorated oil, *dikamali* ointment or some other preparation which will keep flies away (*see* Appendix 128, 130, and 137) should be placed between the lips of the wound, to prevent its closing too rapidly. Dressings can be kept in place by using strips of good resin plaster. The cavity will require dressing at least once daily till healed. In neglected cases when the skin has become undermined, and this may be extensive in every direction, to promote the healing process it is necessary to have recourse to caustic solutions. The cavities should be syringed out with tincture of iodine 1 to 2 drachms to the pint, carbolic acid (1 to 20), or sul-

phate of zinc or copper lotion 5 grains to the ounce (also see Appendix 98 to 102), after which as a rule healing commences; if not, the injection must be repeated every second or third day till the wound assumes a healthy aspect. Where pockets exist one or more openings should be made so that the discharges can completely drain away and to keep up the irritation pieces of tape previously disinfected may be passed from the original wound through the new openings and then knotted, or a piece of wood tied at each of the ends to keep them from slipping through; the tapes should be moved up and down once or twice a day and removed as soon as a healthy discharge issues. In old-standing cases a blister or strong liniment applied over the undermined portion but not on the wound itself often promotes healing. All incisions through the skin should, as much as possible, be made in the direction of the natural folds or wrinkles, not across them; otherwise they will gape, and when healed leave ugly scars (see Fig. 32).

Abscess of the foot.

Causes.—The sole of the foot is comparatively thin, and nature intended it for transit over soft ground; it follows therefore that when an animal is put to constant work on hard roads or rough country, especially when the work is carried on for protracted intervals, the slipper or sole becomes unduly worn and attenuated, and in this condition may very easily be severely bruised or wounded by even blunt bodies, and abscess is very likely to arise.

Symptoms.—Are the same as already described, with no swelling, or at least so slight as to easily escape notice, intense pain (especially when pressed with the fingers), to which lameness is superadded, or the animal by his posture may arouse suspicion, such as constantly resting the affected foot. Inflammation as in other parts is apt to extend, in which case heat and puffiness may be observed around the hoof slipper or even above the nails. Matter frequently, owing to its being unable to find an exit at the sole, burrows upwards and escapes above the nails at the junction of the slipper with the skin, sometimes leaving a passage, or sinus.

Treatment.—As soon as an animal shows signs of lameness the foot should be examined most carefully for wounds. By gently tapping the sole with a hammer if any tenderness is evinced, or if any undue heat can be noticed with the hand, the animal must be forthwith rested, and, if this is done early enough, trouble may be averted; the sole must be thoroughly cleansed with brush and carbolyzed soft soap and water and a cold bran poultice applied, but, if

this does not reduce the heat and tenderness in twenty-four hours or thereabouts, hot fomentations should be substituted and the temperature taken every four hours or so, for, if the inflammation is of a severe character, the thermometer is sure to show a rise, in which case there should be no delay in opening the abscess. In this situation owing to the horny nature of the sole it should be pared over the seat of inflammation till quite thin before using the knife; this procedure should immediately be carried out in the case of punctured wounds in anticipation of future mischief. After this treat the abscess as above described; should a fistulous opening appear in the parts already mentioned, injection of sulphate of zinc, or copper, 2 to 5 grains to the ounce (*see* Appendix 98 to 102) should be tried and, if necessary, repeated, and the parts dressed. In all injuries of the feet the foot should be dressed and enveloped in gunny and placed in a leather boot.

Abscess (serous).

What are known as serous abscesses are occasionally met with, they may contain blood, serum, &c.

Causes.—Falls or severe blows.

Symptoms.—After a heavy fall or a severe blow a swelling suddenly appears, fluctuation may be detected, there may be no heat or pain, as in an acute abscess containing matter, the effused material may be blood or serum the result of direct injury to the underlying tissues, or rupture of some of the vessels.

Treatment.—Rest, a purgative and frequent fomentation, which usually brings about absorption of the effused material; but, should the swelling increase and be accompanied by doughiness, increased pain, heat, tenderness and fever, it may be inferred that matter has formed (purulent abscess), and must accordingly be evacuated without delay and treated as laid down.

Boils.

Boils are frequently met with in this animal confined to no particular part of the body, but perhaps more often seen on the front of face or quarters, inside of thighs, and under the belly, but they may be distributed all over the body. They may be either boils which proceed to suppuration, or what are known as "blind boils," that is, they do not go on to the formation of matter and may disappear with or without treatment.

Causes.—Derangement of the digestive organs especially the liver, and depravity of blood from any cause. “Intelligent mahouts say they may arise from the too free use of mercury”—(*Hawkes*).

Symptoms.—A circumscribed, hard, elevated swelling of the skin, often painful and tender to the touch, not as a rule disposed to come to a head. If a boil bursts, a tough slough of the deeper parts of the skin and even the tissues beneath, commonly called the “*core*,” is disclosed.

Treatment.—The cause must be sought for, if the digestive system be out of order, the state of the bowels must be attended to, and kept regular by means of laxatives, purgatives or enemas, as the strength of the animal may indicate. Small doses of aloes, about 3 drachms, and calomel 30 to 40 grains every alternate day for a week may do good. If the animal be weak, good mixed food, boiled rice, may be given, also some cordial (*see* Appendix 11 to 14) conjoined with tonics may be administered.

Local.—Foment with warm water and open as early as possible otherwise the matter may burrow; for procedure *see* abscess. After evacuation foment and treat as an ordinary wound.

Disease of the nails.

Warty growths around the Nails.—This is not a very rare affection amongst timber working elephants, especially those that constantly work in water; these growths, which resemble warts around the top of the nails, do not as a rule give trouble while animals are working in dry places, but when worked in water they often soften and ulcerate, sometimes causing nasty angry sores. The animal is not ordinarily incapacitated from work nor does he go lame.

Treatment.—Keep the animal out of water, and the feet dry and clean, and treat sores as laid down under ulcers.

Ingrowing and Overgrown Nails.—Elephants, especially those that work much in water, are liable to ingrowing nails. Again, injuries to the feet, such as frequently happen while elephants are walking about logs, may cause one or more nails to grow out in an unnatural manner.

An ingrowing nail may cause much pain and lameness. Sometimes a little proud flesh is noticed about the position where the nail is buried.

Treatment.—Remove with a sharp knife. If the animal is kept standing for some hours in cold water, the nail is softened and can be

cut ; moreover, owing to the effects of the cold, the amount of pain caused during operation is diminished.

When nails are overgrown, the offending portion may be removed with a fret saw ; but, if the foot has been placed in water for an hour or two, an ordinary strong, sharp knife will be found to answer the purpose.

Moisture around and under the nails.

Causes.—Usually bad sanitation, or standing continually in wet places.

Symptoms.—Itchiness manifested by the animal rubbing one foot against the other. If the nails are pressed, a nasty smelling discharge may be observed issuing at the junction of the nails and skin, and also from beneath them. These cases are at times troublesome, especially when there is much discharge from under the nails.

Treatment.—Cleanliness and keeping the feet dry is essential. The affected parts must be thoroughly washed at least once daily with some weak antiseptic lotion, and dressed with iodoform ointment, dry calomel, carbolic acid ointment. As the case improves, tar dressing may be applied.

Most of these affections of the feet are due to want of proper care and management.

Eczema.

This disease is by no means rare amongst elephants.

Causes.—More common among animals subjected to treatment opposed to their natural habits, such as keeping them tethered in the sun, feeding on coarse indigestible grass, or on leaves and boughs of trees unpalatable to them ; or not varying the diet ; want of cleanliness as regards grooming and washing. Defective nutrition of the skin, sudden alteration in diet. In fact any condition liable to bring about an unhealthy state of the system is calculated to provoke an attack. I have heard it called mange ; this is incorrect, as it differs from that disease in that it does not depend on the presence of a parasite, and that it is non-contagious. Several animals may, however, be attacked at the same time, but the reason for this is, that generally speaking those that suffer have been partaking of the same kind of food and in other matters subjected to similar treatment. The disease may attack animals in good condition, but is more common and severe in those that are aged or debilitated. In my experience the malady is met with most frequently during the hot weather. The disease is also liable to recur,

Symptoms.—Irritation of the skin, manifested by a desire on the part of the animal to rub the body against posts, trees; the skin on examination will be found to be hot and tender. This is followed by crops of blisters or vesicles; in the milder cases observed about neck, shoulders, and quarters, but in those that are more severe, may also be seen on the head, ears, neck, sides of belly and between thighs. These vesicles burst, the discharge drying on the surface. Successive crops of blisters may appear. In severe cases there may be a watery discharge from the eyes, which later become whitish, or the corneæ may become clouded.

Treatment: General.—Attention to general management, with regard to shelter, food, and cleanliness, and especially stabling for a time on a boarded, cement, or other flooring, free from dust, and sand, and removing any defect that may be found in above. Tonics, *see* Appendix Nos. 39 to 46.

Local.—The eruptions must receive careful attention, the crusts must be soaked in sweet oil for some hours and then removed by washing. The resulting raw surfaces must be cleansed with weak carbolic, 1—60; phenyle, 1—60; permanganate of potash 2 or 3 grains to the pint, after which they should be dressed with any of the following,—Acetate of lead 1 drachm, glycerine 1 ounce, and water a pint; or substitute powdered borax 2 or 3 drachms for the lead. As the case improves carbolic oil, *dikamali* ointment, or boracic acid ointment may be used with benefit.

The eyes when affected must be treated as laid down under inflammation of cornea. I have seen one case where sloughing of portions of the tail and ears were superadded to the above, but whether dependent or independent of this affection I am not prepared to venture an opinion. From poor to luxuriant pasture A high surrounding temperature.

Urticaria.

Nettle-rash or surfeit may occasionally be met with. It consists of an eruption on the skin, which is usually very sudden in its appearance. The rash may be general, or appear only in patches.

Causes.—The more frequent causes are errors in diet, such as sudden changes of food, from poor to luxuriant pasture, allowing animals to drink freely when the body is heated. A high surrounding temperature.

Symptoms.—As a rule there is little or no constitutional disturbance to speak of. The rash appears as elastic lumps of varying size, sometimes being as large as walnuts, and is usually seen about the neck, shoulders, and sides of abdomen.

Treatment.—Care and attention to watering, feeding, and exercise. A dose of physic is usually sufficient to disperse the rash. If the patient is weak, a course of iron tonics generally proves beneficial (*see* Appendix Nos. 41 and 42); bicarbonate of soda in $\frac{1}{2}$ ounce doses twice daily very often yields good results.

Pityriasis or scurf.

Causes.—Elephants that are badly cared for, and whose general health suffer in consequence, are specially liable to this disease; it, however, may also occur amongst animals that are irregularly worked, but in other respects well cared for.

Symptoms.—A general unthriftiness of the skin, which may be hot and very tender. Irritation may or may not be present. If the skin be carefully examined, it may be observed that the scales which resemble dry bran are being cast off on all parts of the body. The hair on the body and tail is easily removed. In some cases the skin may be noticed to be rather harsh, in others it remains soft and pliable.

Treatment.—A change of food and to the jungle is usually beneficial in these cases. If the patient has been over-fed, the quantity should be reduced. In cases where debility is present, a liberal allowance is to be made, and the fodder should be clean and fresh. Attention must be paid to the state of the digestion, and also to the action of the bowels. Regular exercise, regulated in accordance with the strength of the patient, is essential. The body should be lightly groomed daily with a soft brush or cocoanut fibre glove, and afterwards washed with carbolized soft soap and water, and occasionally with a weak solution of washing soda. Internally, a course of tonics, of which the best results are obtained from the administration of iron, or arsenic, or both.

External parasites.

These huge creatures are not exempt from the annoyance of flies; mosquitoes even causing them great irritation.

Fleming in his "Animal Plagues" mentions that—

"A. D. 260. When Saphor, King of Persia, was besieging Nisibus, his elephants and beasts of burden were so suddenly and furiously attacked by swarms of gnats as to kill or disable them, thus causing the siege to be raised, and subsequently leading to the discomfiture of that monarch's army" (*Theodorite, Hist: Eccles, Book ii, page 30*). We have nothing as bad as this in Burma.

Steel, page 53, also records that "the tsetze fly in South Africa has proved a serious enemy to the elephant, its poison giving rise to anthracoid symptoms and rapidly fatal results."

In Burma in certain tracts, and at certain seasons of the year, flies and other pests are very troublesome to all animals.

The elephant fly.—This insect is very numerous in many places, especially after the first few thunderstorms at the end of the hot weather. On the appearance of an animal they swarm out of the jungle and attack it, and owing to their numbers and the severity of their bites often cause much irritation and soreness of the skin. When these flies are about, elephants become agitated, and with ears flapping, tails and trunks swinging, make very rapid journeys, in order to escape from their tormentors.

Several species of "*oestrus*" or gad-flies occur in Burma, and are a great annoyance to elephants as well as other animals. In one species the female gad-flies attack animals when grazing, their chief object being to deposit their eggs, rather than to obtain sustenance. The eggs are carefully deposited on the skin or hairs about the tusks just where they emerge from their sockets, and about the edge of the lower lip; the ova adhere by means of a glutinous material.

By depositing them in the position noted they are easily licked off by the elephant and conveyed to the mouth, and thus to the stomach. The larvæ are ordinarily known as "bots," technically as the *gastrophilus elephantis*, for descriptions of which see "Parasites," Alimentary Canal. In another variety not uncommon in Burma the females attack and probe the skin about the back, loins, sides, &c., by means of an ovipositor, and place subcutaneously a little acrid fluid with an ovum or egg; this sets up irritation which gives rise to an abscess (known as "*warbles*" in cattle at home). Situated within is a larva or grub: finally the abscess bursts, the larva escapes, falling to the ground, becomes a chrysalis and in due course a gad-fly. When the nature of the swellings is recognized a little pressure applied to them will materially assist in setting the larvæ free. The abscesses should be treated in the ordinary manner. The larvæ of this fly is about $\frac{1}{4}$ inch long and consists of some nine segments. The grubs should be destroyed.

In cases of neglected wounds the maggots of the ordinary fly are occasionally met with. They should always be removed without delay. Camphor and turpentine are most useful. (For treatment, see wounds.)

Pediculi or lice.—Lousiness in the elephant, though as far I am aware very rare, has been noted by some observers. Cobbold in his Treatise on the Entozoa of Man and Animals, page 399, notes: "A species of mite has been described whose generic position

appears doubtful. I allude to *Homopus elephantis* of Furstenberg, or *Symbiotes elephantis* of Gerlach. According to Mignin it is *Nymphæ adventive* or *hypope* of a variety of *Tyroglyphus siro*. This *acarus* is abundant in old forage. Another ectozoon is *Hæmatomyzus elephantis*. It differs from the lice proper in many respects, but, according to Piaget, the reproductive organs resemble those of *hæmatopinus*. In *Science Gossip* for June, 1871, Mr. H. C. Richter describes "a new form of parasite" which is called *Idolocoris elephantis*. The insect, which was one line in length, was found upon an elephant in Ceylon. According to Walker it not only constituted the type of a new genus, but of an altogether new family of the *Hemiptera heteroptera*, coming very near to the bed bugs (*Acanthidæ*). It is a huge sucking louse. From the discussion which followed, it seems that the parasite had several times been seen before, and was none other than E. Piaget's *Hæmatomyzus elephantis*. Excellent figures accompany Richter's and Piaget's descriptions."

Lice generally, though by no means always, attack animals that are ill-kept and poor in condition.

Symptoms.—Constant irritation evidenced by the animal frequently rubbing himself. In such cases a careful examination of the skin is necessary; if lice be present, they may quickly be detected.

Treatment.—Immediate segregation of the affected animal. The body must be thoroughly washed, preferably with carbolic soft soap and water, after which, from experience with other animals, I can strongly recommend the following dressing recommended by Adams. He writes as follows: "After drying, apply to every part of the skin a mixture of tobacco water and sulphur $\frac{1}{2}$ an ounce of each to a pint of boiling water. This must be applied for two consecutive days and on the third day the horse must be again washed as before. It will be seldom found necessary to repeat this." This dressing, he remarks, "has the advantage of being simple, ready at hand, not likely to do harm if used with ordinary caution, inexpensive, and effectual." The lice are killed easily enough, but the eggs or "nits" are difficult to destroy. Other dressings in which a little tar or turpentine is mixed with oil act well, as also does plain decoction of tobacco leaves, $\frac{1}{2}$ an ounce to a pint of boiling water; the vessel should be covered and allowed to stand for half an hour or so, after which the liquid may be strained through a piece of calico. If the elephant has been standing in a shed, it is essential that all wood-work, be thoroughly washed with boiling water, to which crude carbolic acid or phenyle has been added. It may even be necessary to apply tar. All gear had better be destroyed by fire,

or at least be saturated with carbolized boiling water. This should be repeated daily for two or three days.

Poultry, which are proverbially full of vermin, should not be allowed in elephant sheds.

Ticks.—They belong to the family *Ixodidae*, and are plentiful enough both as regard species and numbers. They are blood-suckers; the mouth is provided with a serrated rostrum, or beak, by means of which they can pierce the skin and retain a firm hold.

They may be induced to release their hold by applications of turpentine and oil, or by adding a little earth or kerosene oil to some ordinary sweet oil. Once ticks have secured a firm hold they should not be removed forcibly; they are likely to leave their heads behind, a nasty sore resulting from the irritation.

Leeches.—Family *Hirudinae*. During the rains the large water-leeches may attach themselves and, when fixed, will suck blood freely until they become distended to very many times their original size. They should not be removed forcibly. The ordinary Burmese method, namely, to place the lighted end of a *selaik* (Burmese cheroot) in close proximity to their bodies soon causes them to relax their hold.

Mosquitoes.—During the rainy season, especially at night, these insects are so numerous, and their bites so irritating, that domestic animals can hardly obtain rest. Fires should be lit near their standings. Animals, I feel sure, readily recognize the value of smoke as a protection against flies. Wild elephants protect themselves against insect tormentors by wallowing in mud, with which they cover themselves so thoroughly that, when standing quietly in the jungle, they are not unlike ant-hills.

Tender feet or "thullee."

This is a very common ailment.

Causes.—Continued marching over hard or stony ground, especially during the hot weather; it also occurs amongst animals that are marched first through swampy wet grounds and then over stony or rocky country. Animals habitually kept on dirty standings are liable to it. Steel mentions that elephants employed in heavy draught are liable to overwear at the junction of the hoof slipper with the skin.

Symptoms.—Short action, at times lameness. If the feet be examined, the tender parts will be at once seen; they are quite smooth and of a yellowish or pinkish colour, and, if pressed, the animal shows evidence of pain.

Treatment.—Regular inspection of the feet; if a tender patch be observed, the animal should be rested forthwith. The standing should be of dry earth, not sand. Rest and keeping the feet dry is the only treatment. Mahouts, to prevent the occurrence, use astringent mixtures, called *chobing* which have been found of practical value. Hawkes recommends—

					Tolas.
Aloes	...	...	...	...	24
Wax	...	...	...	...	24
Dammer	...	...	...	...	24
Grease	...	...	...	...	24
Catechu	...	...	...	...	96

Melt together and apply as an ointment to the feet. One tola equals 3 drachms—(*Hawkes*).

Steel, condensing one of Gilchrist's formulæ for *chobing*, gives the following prescription:—

Catechu powdered	...	...	...	12 ounces.
Galls powdered	...	...	...	1 pound.
Wax powdered	...	...	...	2 pounds.
Gingili oil (<i>hnan-si</i>)	...	...	...	4 pounds.

Melt together and apply to the soles of feet night and morning.

Take a large quantity of the bark of the "jack" and palmyra trees, boil with plenty of water for about four hours till reduced to about 6 or 7 quarts, then strain it through a cloth and while hot add the following:—

Catechu	...	...	...	2 ounces.
Soda	...	...	...	2 ounces.
Wax	...	...	...	4 ounces.
Sweet-oil	...	...	...	2 bottles.

To *chobe* the feet the animal is made to lie down as when sleeping; the feet must be thoroughly cleaned by washing, after which apply the *chobing* warm; this may be carried out with a mop. *Chobing* is an excellent thing for hardening the soles of the feet.

Inflammation of the feet or laminitis.

Causes.—Prolonged work, especially over hard ground during the hot weather months. It may also result as part of a general chill, when an elephant fatigued by exertion is taken into cold water. Steel mentions as causes, high feeding, too free use of massauls, and that it is a complication in foot-and-mouth disease.

Symptoms.—Lameness, the animal very often being unable to stand, lies on his side, high fever, great heat around the foot-pad. I have met with two cases; these were in animals that had done a deal of heavy marching without due rest.

Treatment: General and Local.—As laid down for fever.

Local.—Envelope the feet in blue clay [*shun*, ㄅㄨㄣˊ], or stand the animal in wet mud, or cover with gunny, and keep constantly wet with cold water; if bran be at hand, cold poultices may do good. In some cases fomentations afford great relief.

Steel mentions that oozing takes place at the margin of the slipper, and also that shedding of the hoof slipper is not uncommon, on account of effusion between the horny structures and the sensitive parts which produce them. I have never met with such severe cases, but it is necessary to keep a sharp look-out for such complications. Steel notes that death has been known to result from mortification. In the event of the hoof-slipper being cast, the foot must be kept perfectly clean and thoroughly protected, till a new slipper has been produced.

CHAPTER XVI.

MISCELLANEOUS—SPRAINS—FRACTURE—"GUNRUSS" AND "CHOWRUNG"—CRAMP—
MOOKUNDAH.

Sprains.

THE elephant, though a sure-footed animal, is liable to sprains, especially of the joints a little above the pad in the fore, and middle of hind, limbs. They occur when animals have to pass over rocky ground, getting a foot suddenly wedged between heavy logs, placing a foot on unsound ground, and it is surprising how frequently elephants will do this, though they are credited with being so very careful, working in heavy mud, such as tidal creeks. Wild elephants do not appear to be more cautious than tame ones, as it is not unusual, when following up a herd, to find that a member of it has walked upon ground apparently sound, and on which one of his legs has gone through to a depth of a couple of feet or more, and I have on two or three occasions come on places where a bank has given way, and by the saplings, bushes, knocked down, there was little doubt that the elephant went down also. I also witnessed an accident where a loaded elephant was walking along on a newly made road, when it suddenly gave way under him, and he rolled down some 40 or 50 feet screaming and trumpeting. We had to get a couple of elephants down to assist him to rise after the load was removed. The camp was fortunately not far off, so he was walked in quietly without his load. He showed no symptoms that day beyond stiffness, but next morning he could hardly move; one of his legs, near hind, was much swollen from foot upwards for about a foot, and he was very tender and sore over the loins. He made a good recovery under treatment, but it took two months to get him round.

Fording streams with a rocky bottom, especially where there are a number of large loose stones, renders animals liable to sprain, as also does overloading, hurrying them, especially in hilly country.

Symptoms.—Enquire into the history of the case. Lameness, heat, swelling, tenderness, and pain. There is often very great pain when the joint is involved, so much so as to induce fever and loss of appetite.

Treatment.—Cold water continuously applied, or hot water fomentations applied frequently; cooling lotions may also be tried.

When the inflammation has subsided, a smart blister should be applied. Liniments (*see* Appendix 70 to 74).

Injury to the loins.—In these cases the injury usually takes place when a loaded animal is going down a very steep place; his fore-legs may suddenly slip ahead, and to stop himself he drops his hind legs in the ordinary way, but in these circumstances he has not time to do it quietly, and the suddenness and consequent strain may hurt the muscles of the back. A history of the case will afford much assistance in these accidents. I have never seen an animal totally disabled. If an elephant after a slip shows any difficulty in rising, very often manifested by the animal trumpeting, the load must be removed forthwith and a couple of elephants brought to give a hand to enable him to rise. Once on his legs after he has finished trembling, the mahouts should massage the back in the usual manner, and then take him quietly into camp if he can be moved. Several days' rest may be necessary.

The treatment consists in warm applications to the back, massage (which operation is well carried out by Burman, Karen, and Shan mahouts), and the application of strong liniments. When better, gentle exercise is to be allowed. It is advisable for some time after such an accident that the animal be loaded lightly; it is also as well not to put him to any heavy work such as *aunging* heavy timber.

Fracture.

Is a solution of continuity in a bone and is a very rare accident in elephants. I have only seen one case and that was in the fore-leg, a little above the knee. The animal recovered with a distorted limb and was able to do a certain amount of work after.

Causes.—Undue violence, such as sudden slips, especially with a heavy load, or falls, struggling to extricate the limbs from heavy boggy ground.

Symptoms.—If in a limb, there will be loss of power and inability to sustain weight on it, swelling, and pain.

Treatment.—The animal may be given a chance, absolute rest being enforced for at least three months, after which, if the slightest use cannot be made of the limb, the animal had better be destroyed.

"Gunruss" and "Chowrung."

These are terms applied by native mahouts to certain affections of the feet. In the former only the fore-feet are attacked; in the latter the limbs and all the feet are involved.

Gilchrist and Hawkes state that the condition known supervenes in some animals that have been allowed to take during the time they were eating earth. It is manifested by stin. and a turning outwards of the feet, but, except in severe cases, motion or efficiency of the affected animal is not impaired.

“*Chowrung.*”—Is an aggravated form of the above. It may arise from chills, or from crossing rivers when the body is heated.

Treatment.—Is to avoid the causes such as mentioned. The patient should be protected from cold, rain, and given stimulants, and good food. I feel certain that many of these cases are rheumatic.

Cramp.

Cramp is a spasm of muscle of variable extent, *i.e.*, many muscles may be attacked or only a few.

Causes.—Cold, especially entering water in an exhausted or heated condition.

Symptoms.—The animal suddenly is incapable of using his limbs, which become painful and stiff owing to muscular contraction. In deep water when he discovers his helplessness he loses his head and is drowned. This is a common accident, and in deep water a very fatal one. In these cases of drowning, Burmans attribute cause of death to the bite of a mythical fish *yesin* (၁၄၀၀၀) or *natsin* (၂၀၀၀၀).

“Mookunda.”

Is an affection described by various authors as a result of permitting an elephant to have his ration of rice during the period he is eating earth as a remedy for worms.

Symptoms.—Swelling of the abdomen, accompanied by pain and restlessness; the animal appears dull and listless; the surface of the body is cold. There is no diarrhœa.

Treatment.—Grain should be withheld and a purgative given, after which tonics containing arsenic or iron, or both, may be employed.

CHAPTER XVII.

WEIGHTS AND MEASURES—PREPARATION OF MEDICINES AND MODE OF ADMINISTRATION—INSTRUMENTS.

Weights and measures.

Weights.

One grain, gr.
 One ounce, oz. = 437.5 grains.
 One pound, lb. = 16 ounces = 7,000 grs.

Apothecaries' measure of weight.

One grain	...	...	...	...	<i>gr</i>
One scruple = 20 grains	...	...	...	...	<i>ʒ</i>
One drachm = 3 scruples = 60 grains	...	...	...	...	<i>ʒ</i>
One ounce = 8 drachms = 480 grains	...	...	...	...	<i>ʒ</i>
One pound = 12 ounces = 5,760 grains	...	...	...	...	<i>lb</i>

Measure of capacity.

One minim	...	...	...	...	<i>mi</i>
One fluid drachm = 60 minims	...	...	...	...	<i>f ʒ</i>
One fluid ounce = 8 fluid drachms	...	...	...	...	<i>f ʒ</i>
One pint = 20 fluid ounces	...	...	...	...	<i>pt</i>
One quart = 2 pints	...	...	...	...	<i>qt</i>
One gallon = 4 quarts	...	...	...	...	<i>g</i>

Weights used by Mahouts.

One tola = 3 drachms = weight of one rupee.
 One scruple = $\frac{1}{3}$ th tola = weight of two-anna piece.
 One drachm = $\frac{1}{3}$ rd tola = weight of three two-anna pieces.
 One and half drachms = $\frac{1}{2}$ tola = weight of eight-anna piece.
 Two drachms 10 grains = $\frac{2}{3}$ tola = weight of three four-anna piece.
 Four drachms = $\frac{4}{3}$ ounce = $1\frac{1}{3}$ tolas = one rupee and one four-anna piece.
 Eight drachms = 1 ounce = $2\frac{2}{3}$ tolas = two rupees and one eight-anna piece.
 Two ounces = $5\frac{1}{3}$ tolas.
 One pound (apothecaries) 32 tolas.
 One seer = about two pounds.
 One chittack = two ounces.

If standard measures are not at hand, house utensils may be employed. The ordinary pint bottle contains about thirteen ounces and the quart twenty-seven ounces.

Common tumblers from ten to twelve ounces, breakfast cups about eight ounces, and wine glasses two to two-and-a-half ounces.

Preparation of medicines and mode of administration.

As already pointed out Veterinary Surgeons rarely have an opportunity of treating elephants, and as owners usually do not know much about their ailments, the treatment is invariably left to the mahouts.

These men employ a multiplicity of drugs to make up their formulæ or mussauls ; they are purchased in the bazaar, and I have frequently seen them ; excepting the curry-stuffs, the vegetable drugs are usually old, mildewed, and inert, and the minerals impure.

The expense incurred by the purchase of reliable drugs from a chemist, where purity, freshness, and uniformity in strength are guaranteed, would at the end of a year be far less than the cost of the ordinary expensive mussauls so frequently indented for. A good many of the curry-stuffs supposed to enter into them often find their way to the mahouts' quarters. I have come to the conclusion that domestic elephants must carry a special heat generating apparatus in their interiors, as *gurmi* or heat seems to be the most prevalent ailment amongst them, and the amount of *cooling* mussauls required is truly surprising.

No drug is known to have an emetic action on this animal. Gilchrist mentions that "tartar emetic has been given in two-ounce doses morning and evening till half a pound was taken, but no emetic or other obvious medicinal effect followed."

Mahouts are strongly averse to the administration of purgatives ; in fact they never intentionally purge an animal, though such drugs as croton seeds, aloes, in small doses, enter into the composition of many of their mussauls.

Doses.—The question of the amount of a drug to be given is a matter of some difficulty, seeing how very rare it is that opportunities offer for trying experiments on these valuable creatures. There can be little doubt, however, that, misled by the size of the animal, drugs have been administered in what appears as excessively large doses and not free from risks ; perhaps bazaar drugs were used, thus leading to this error as they are often impure or inert. To be on the safe side, I have always been guided by the doses given by Steel, and as he employed drugs of known strength, I would recommend others to do the same. I have, however, given the doses given by other authors and have also added many of their mussauls.

Preparation.—All drugs should be finely powdered and mixed with some spice, jaggery, honey, tamarind pulp, boiled rice, plantains to mask the taste as much as possible. The mixture is then made into pills about the size of a small orange.

Administration.—The administration of drugs is not always an easy matter : the mouth is very small and to add to the difficulty the back of the tongue is free. In order to render it easier to give medicine, it is an excellent plan to accustom an elephant to take small packets filled with paddy, rice, tamarind, sugar, or sweets, flavoured with some spice. The packets are generally made of straw, grass, and at times a plantain leaf is used. Wheaten bread or native bread

(chupatties) should occasionally be given, in which a little salt, spice, garlic, or onions, have been incorporated. An animal soon learns to appreciate these delicacies and will open his mouth when he sees the mahout bringing a packet, which he can place in the creature's mouth without trouble. By the means above mentioned animals are rendered unsuspecting, and drugs may be incorporated and often given without trouble. The usual method is first to give a couple of packets of rice or sugar, and, in the following one to place rice at the bottom of the packet, then the pill which is covered over with more rice or tamarind, then secured and shoved into the mouth. Nauseous drugs are sometimes ejected.

Liquid medicines are often soaked up in bread and rolled in a chuppatee or leaf and given. Tasteless drugs may be given in drinking water, especially if water has been withheld for some little time. Good mahouts are wonderfully clever in getting their animals to take medicines.

For troublesome animals the following plan may be adopted. He should first of all be well fettered and have a rope tied round the neck. A wooden gag is then inserted into the mouth and secured by the ropes at the ends to the neck rope. The gag should be about $2\frac{1}{2}$ feet long, 6 inches broad and 2 inches thick, the hole in the centre should be at least 4 inches in diameter, that is, large enough to permit the hand to pass through (fig. 35); the tongue offers some resistance, and care must be taken that the hand is not pushed to one side between the grinders; once the pill is pushed to the back of the mouth the animal is forced to swallow. Liquids should be carried into the mouth in a plantain leaf or in a small joint of bamboo, the edges of which must be rounded off.

Steel recommends that liquid medicines be pumped into the mouth by means of an enema syringe, such as Read's patent. The ordinary nozzle piece might be used for this purpose.

Castor and linseed oil are sometimes given in the following manner. The oil is placed in a tin and some spice, such as cardamom or cinnamon, mixed with it. The mahout then puts his hand into the mixture and rubs the medicine into the animal's mouth till the whole is finished.

Hypodermic injection.—By means of a special syringe drugs may be introduced beneath the skin; when so injected they are quickly absorbed and their action rapidly manifested. The skin is not difficult to penetrate with a good needle, such as supplied for introducing Pasteur's vaccine. If necessary, a small incision through the skin may be made and the needle introduced. For hypodermic injections in human and veterinary practice, solutions of the active principles of drugs are generally used, such as, when opium is indicated, a small quantity of solution of morphia is employed.

Instruments.

Clinical thermometers.—No elephant establishment should be without this invaluable instrument as it is a never failing guide to the state of the health of the animal or to what it may shortly be. If there is a rise of temperature, even if no other symptoms of ill-health are manifest, we may rest assured that disease in some form will soon make itself evident: a rise of temperature is a certain indication that the animal is indisposed and should therefore be relieved from work and carefully treated and watched.

These instruments are of delicate construction and therefore in elephant practice it is well to have them guarded by a special case; they should be at least 8 inches in length, provided with a sensitive bulb (such instruments require only a minute to register temperature), and should be made with an indestructible and magnified index, and be graduated from 90° or 95° F. to 110° F. (*vide* remarks on fever).

Forceps.—Two pairs, bow or dressing forceps, useful for removal of dressings. Dissecting forceps (two) for the removal of maggots, &c.

Measure glasses.—Minim, 4 ounces, 1 pint.

Mortar and pestle.—Iron, and Wedgwood (two).

Needles.—These should have very sharp edges, be slightly curved towards point, and be about 4 inches in length.

For this climate they should be plated to prevent rusting. There are many patterns; those most likely to be useful are suture needles to carry stout wire; needle forceps or handles must be procured owing to the difficulty in passing them through the skin.

Seton needles.—Two, 11" and 13" in length, with very sharp points and edges, and provided with a handle.

Probes—Whalebone. Two or three 8" to 12" in length. Used in examining and ascertaining extent of wounds, also for feeling for foreign bodies, &c. Care must be exercised in using probes in the vicinity of joints.

Saw.—Fret saw for teeth, and ordinary saw for cutting tusks.

Scales and weights.—Grain scales and weights. Scales and weights from 2 pounds down.

Scalpels.—Four stout knives with metal handles to enable them to be boiled after use, employed for opening abscesses, &c. One knife for cutting horn, such as the nails.

Scissors.—One dressing scissors, one trimming scissors.

Enema.—Read's patent enema pump (brass), capacity one quart or 3 pints; also two ebony pipes; the ordinary one used in horse

practice, about 10" or 11" long, may be used for administering liquid medicines through the mouth as suggested by Steel. The other for giving enemas should at least be double the length, 22" to 24" in length, slightly thicker, with a larger passage. Eight to 10 feet of good rubber tubing is requisite; this can be fitted on to the screws of the syringe and ebony pipe.

In case this pattern is not obtainable an enema funnel may be used of the pattern (*see* fig. 34); the length of the pipe must be 2 feet at least.

Syringes.—One wound syringe (Bowles' pattern), with three metal bulbous pipes, the longest to be 8 inches, for syringing out abscesses, wounds, &c., or two Quittor syringes (brass), with finger rings ($\frac{1}{2}$ to 1 pint), and glass syringes (1 to 2 ounces), for introduction of eye lotions, &c.

Care of instruments.—All instruments after use must immediately be thoroughly cleansed, disinfected, oiled, and locked up.

Steel instruments and knives with metal handles should be boiled after use, then cleansed with carbolic (not corrosive sublimate) lotion, dried, then oiled and put away; and again before use they should be allowed to stand in a solution of carbolic acid or phenyle for some minutes. These details may seem trifling and unnecessary, but it is by careful attention to such, as disinfection of the hands instruments, &c., that go a long way towards bringing about satisfactory results.

APPENDICES.

APPENDIX A.

List of drugs employed in the treatment of elephants, with their native names, actions, uses, and doses.*

Drugs.	Hindustani.	Burmese.	Uses.			Doses.			Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.		
Abrus precatorius leaves.	Gauchi	.....	.....	Bruised leaves to swellings as a suppurative and detergent specially indicated in blind boils.— <i>Steel.</i>	..	..	..	..	Used instead of liquorice root.— <i>Steel.</i>
Acacia gummi	Goood, Babul.— <i>Steel.</i>	.....	.....	Emollient ..	Ad lib.	..	Ad lib.	..	
Acacia gummi (mucilage).	.....	.....	.....	Ditto.	.....	.....	.....	.....
Acetate of morphia.	.....	.....	.....	Anodyne, eye lotion.	.....	.....	.....	.....
Acetum	Sirka	.....	.....	Rubefacient, antiseptic.— <i>Steel.</i>	About ½ pint.	.....	4 ozs	.....	Vinegar.
Acid arseniosum	Sufed sambul.— <i>Steel.</i> Sornul.— <i>Slymm.</i>	.....	.....	Cooling.— <i>Fuson.</i> Stimulant.— <i>Finey Dum.</i>	.....	.....	6 to 20 grains.	.....	White arsenic.
Acid, boracic	.....	.....	.....	Caustic.— <i>Steel</i> ..	.....	.....	.....	.....
Acid, boracic, lotion.	.....	.....	.....	In wounds and burns; antiseptic.	.....	.....	.....	.....
Acid, boracic, lotion.	.....	.....	.....	Ditto.	.....	.....	.....	.....
Acid, boracic, ointment.	.....	.....	.....	Ditto.	.....	.....	.....	.....
Acid, carbolic, lotion.	.....	.....	.....	Caustic, disinfectant, astringent, styptic.— <i>Fuson.</i>	About 2 drachms.	.....	.....	.....	2 drachms (well diluted),
Acid, carbolic, oil.	.....	.....	.....	Washing and cleansing, disinfecting wounds, hands; disinfecting sheds, instruments, carcasses, &c.	.....	.....	.....	.....
Acid, carbolic, ointment.	.....	.....	.....	Dressing for wounds, sores, and ulcers.	.....	.....	.....	.....
Acid, gallic	.....	.....	.....	Dressing for wounds, sores and ulcers. To also in ghing and unhealthy wounds.— <i>Fuson.</i>	.....	.....	.....	.....
Acid, nitric	Shora ka tezab.— <i>Steel.</i>	.....	.....	Astringent, styptic.— <i>Fuson</i> ..	.....	.....	.....	.....	1 to 2 drachms.
				Caustic.— <i>Steel.</i> Deodorizer, disinfectant.— <i>Fuson.</i>	.....	.....	.....	.....

* The *Materia Medica Veterinaria Indica* (Indian Veterinary Manual), Part I, by Veterinary Surgeons Steel and Symonds, A. V. D., published by the Lawrence Asylum Press, Madras, contains valuable information on Indian drugs, their actions and uses, and is strongly recommended for ready reference.

List of drugs employed in the treatment of elephants, with their native names, actions, uses, and doses—continued.

Drugs.	Hindustani.		Burmese.	Uses.			Doses.			Remarks.
	Shora ha tezab	Internal.		External.	Steel.	Slymm.	Gilchrist.			
Acid, citric (dilute).	.....	Tonic, astringent.— <i>Furon</i> . In chronic skin and liver diseases.— <i>Furon</i> .	Cautic, deodorizer, disinfectant.— <i>Furon</i>.	...	...	...	1 to 3 drachms.	Given in a bucket of water.
Acid, tannic ..	.....	Astringent, styptic.— <i>Furon</i> ..	Astringent, styptic.— <i>Furon</i> ..	...	...	...	1 to 2 drachms.	Aconitum napellus.
Acetate leaves..	.....	Sedative.— <i>Steel</i> , <i>Slymm</i> , <i>Furon</i> . Anodyne.— <i>Furon</i> .	Anodyne; always theumatic pain.— <i>Furon</i> .	Doubtful	...	...	...	If Fleming's tincture instead of British Pharmacopoeia preparation is used, dose 5 to 10 drops.
Aconite, tincture	.....	Sedative.— <i>Furon</i> . In fevers	Anodyne.— <i>Furon</i> ...	...	...	...	20 to 30 drops.	Lard.
Adipon, parapa- rala.	Churbi.— <i>Steel</i>	.....	Vehicle.— <i>Steel</i> . Dressing to blistered surfaces, and protects parts from the irritating action of acrid discharges, used in preparation of various ointments.	...	...	...	...	...
Anther ..	.....	Stimulant, narcotic, antispasmodic.— <i>Furon</i> .	Refrigerant.— <i>Furon</i>.	...	...	...	1 to 2 ozs.	Sulphuric ether given in fatigue in an enema.
Aubur, nitrous	.....	Diffusible stimulant.— <i>Steel</i> . Anti-spasmodic, diuretic, diaphoretic.	.....	4 ozs.	...	...	3 to 4 ozs.	Spirits aether nitrosi (Sweet spirits of nitre).
Athusa, egg...	.....	Nutrient; antidote to corrosive poisons.	.....	...	...	...	...	White of egg.
Alleplic	.....	See Pimento.	.....	1 oz.	...	...	...	Impassated juice of the leaf of abce vulgaris.— <i>Furon</i> .
Alsea, Barbados	Moosabhar, liva.— <i>Steel</i>	Purgative, tonic.— <i>Steel</i> . Diuretic, vermifuge.— <i>Furon</i> .	Stimulant to wounds and ulcers.— <i>Steel</i>.	...	...	...	1 to 4 lobas	Dried alum.
Alsea, Barba- dos, enema.	.....	.....	In constipation, colic, worms, &c.	...	...	...	3 drachms.	...
Alum ..	Phikhar.— <i>Steel</i> . Phuktee.— <i>Slymm</i> .	Astringent.— <i>Steel</i> , <i>Slymm</i> . Used as tonic by natives.— <i>Slymm</i> . In obstinate diabetes.— <i>Furon</i> .	Astringent.— <i>Steel</i> . Styptic, collyrium.— <i>Furon</i>.	...	...	...	...	...
Alum, burned ..	.....	.....	Cautic, astringent.— <i>Furon</i> ..	...	...	...	...	...
Alum lotion ..	.....	.....	Astringent in washing wounds, galls (hardening), eye-wash, washing sinuses, &c.	...	...	...	...	...

Ammonia chloride.	Now sagar— <i>Steel</i> .	၈၀၀၀၀၀၀	Liver stimulant.— <i>Steel</i> . Al- terative, absorbent.— <i>Slymm</i> .	Refrigerant.— <i>Steel</i> . Stimulant to sprains and swellings.	1 to 3 oz.	...	...	1 to 1/2 oz.	Sul ammoniac.
Ammonia liniment.	.....	.....	.....	Counter-irritant in sore-throat, rheumatism, sprains, &c.— <i>Turon</i>.	...	...	...	Ad lib. ...	Starch, when mixed with hot water used in enemas.
Ammonia liniment, comp.	.....	.....	Demulcent, emollient.— <i>Turon</i> , In the form of gruel.	Counter-irritant in sore-throat, rheumatism, sprains &c., but more active. When dusted it diminishes discharge from wounds.	...	...	...	1 to 2 oz.	Fruit of pimpirella anisum.— <i>Khory</i> .
Amylum ...	.....	ကပ်	Carminative.— <i>Slymm</i> . Stoma- chic, aromatic.— <i>Turon</i>.	.....	...	...	...	...	Wrightia tinctoria. — <i>Steel</i> . Holar- rhena anti-dysen- terica.— <i>Khory</i> .
Aniseed	Son f.— <i>Slymm</i> . Noawi s o.— <i>Khory</i> .	ထက်ထက်ထက်	Diuretic, anodyne, stimulant. — <i>Khory</i> . Tonic, febrifuge; in dysentery.— <i>Steel</i>.	.....	...	...	...	1 to 4 tolas	...
Anti-dysenterica bark.	.....	ခနောက်ပိန်း	Astringent, stimulant, correct- ive.— <i>Steel</i>.	.....	...	...	...	1 to 3 tolas.	...
Anti-dysenterica seeds.	Inderjou	.....	Astringent, tonic, anti-dysen- teric.— <i>Slymm</i> . Ameliorant. Anthemimetic. chronic chest disease.— <i>Khory</i> Alterative.— <i>Slymm</i>	.....	...	...	...	1 to 2 drachma.	...
Antimony	Soorma	.....	Sedative.— <i>Steel</i> . Alterative, vermifuge, antiphlogistic.— <i>Turon</i> .	Stimulant.— <i>Steel</i> . Counterir- ritant, vesicant.— <i>Turon</i>.	...	...	...	...	...
Antimony tart.	.....	.....	.....	Astringent.— <i>Slymm</i>	...	...	...	...	...
Areca nut	Soopari	ကွမ်းသီး	Astringent, tonic, anthelmintic.— <i>Turon</i>.	.....	...	...	...	...	...
Argent nitras.	Kari khar— <i>Steel</i> . Kahice Kahri Kahrum, — <i>Slymm</i>.	.....	.....	Caustic.— <i>Steel</i> . <i>Slymm</i> . Stimu- lant, astringent.— <i>Turon</i> . Ap- plied to poisoned wounds and bita of rabid animals and venomous snakes.	...	...	...	...	...
Arrack	Dar o.— <i>Steel</i> . Sharab.	ဆရတ်	Stimulant.— <i>Steel</i> . Anti-spa- smodic.— <i>Steel</i> . Diaphoretic, diuretic, expectorant.— <i>Hinay</i> <i>Dun</i> .	Irritant, refrigerant, antiseptic. <i>Hinay Dun</i> .	1 to 2 pints.	...	...	8 to 12 ozs.	Repeated when ne- cessary.
Arenicacidis liq.	.....	.....	.....	.....	...	...	...	1 to 1 oz.	...
Asaethida	Hfing	ရှိန်ခို	Anti-spasmodic, stimulant, ver- mifuge.— <i>Steel</i> . <i>Slymm</i> . Ex- pectorant in cough.— <i>Turon</i>.	.....	...	...	...	1 to 1/2 tolas.	Resin obtained by incision from the living root of a tree which exsuffe- res.— <i>Turon</i> .

List of drugs employed in the treatment of elephants, with their native names, actions, uses, and doses—continued.

Drugs.	Hindustani.	Burmese.	Uses.			Doses.			Remarks.
			Internal.	External.	Stool.	Slymm.	Glicebriat.		
Castor-oil tree stalks.	E r u n d i k a Slymm.	ကြက်ဆူထွေး	Tonic, aperient.— <i>Slymm</i> ...	Leaves made into poultice with barley meal are applied to inflammatory affections of the eye.— <i>Khory</i> . Poultice of crushed seeds good to promote suppuration in boils and reduce rheumatic swellings.— <i>Khory</i> . Astringent, cholagog, sores and ulcers.	...	...	...	Richius communis.
Castor seeds	Brundi binj	ကြက်ဆူ	.....	.....	...	6 to 10 to 15 drachms, # 1 to 1 sec.	5 drachms to 6 ozs.	...
Catechu	Kat, katha	ရှားဝေး	Astringent ...	.....	...	6 to 10 to 15 drachms, # 1 to 1 sec.	5 drachms to 6 ozs.	...
Chalk, prepared	Khary mitti	မြေ	Astringent.— <i>Steel</i> . Antacid, absorbent.— <i>Slymm</i> .	Desiccant.— <i>Steel</i> . Burns and scalds.	...	4 ozs. ...	...	...
Chiretta	Charayata.— <i>Steel</i> .	ထေးဝါး	Tonic.— <i>Steel</i> , <i>Slymm</i> . Stomachic, promotes secretion of bile.— <i>Steel</i> . Alterative, anti-periodic.— <i>Fusion</i> . Stimulant, sedative, anodyne, anti-spasmodic, narcotic.— <i>Fusion</i>.	.....	...	1 to 3 ozs.	...	...
Chloral hydrate	.....	.....	Used in flatulency	.....	...	...	...	...
Chloride of lime	.....	.....	Tonic, anti-periodic, astringent, in fever, rheumatism.	Deodorizer, stimulant, disinfectant, and in skin diseases.	...	...	...	...
Gluchosa bark	.....	.....	Carminative, stimulant.— <i>Slymm</i> . Stomachic, aromatic.	Astringent, antiseptic, to fetid ulcers.— <i>Fusion</i>.	...	...	...	...
Cinnamon	Dakhini taj.— <i>Khory</i> .	သစ်ကြံ	— <i>Harley Durr</i> . Carminative.— <i>Slymm</i> . Stimulant, aromatic, stomachic, in flatulency.— <i>Khory</i>.	.....	...	...	...	...
Cloves	Larung	ထေးညှင်း	.....	.....	...	...	...	...
Coal-tar	.....	.....	.....	.....	...	...	...	...
Colocynth	Indrayen	ကြံဆေး	Hydragogue cathartic; especially valuable in liver congestion.— <i>Steel</i> .	Excitant, antiseptic, in diseases of feet.— <i>Harley Durr</i>.	...	...	...	...
Cocoonat kernel.	Khopra.— <i>Khory</i>	ဆန်ခဲ	Astringent.— <i>Steel</i> . Nourishing, cooling, refrigerating.— <i>Khory</i>.	.....	...	...	...	...
Cocoonat oil	Khopra ka tel; varial ka tel.	ဆန်ခဲ	Emollient, nutritive.— <i>Steel</i> .	Vehicle, wound dressing; promotes growth of hair.	...	...	...	...

Zinger, dry ...	Sohnt	ရှမ်းချောက် ...	Aromatic, stimulant, carminative, tonic, stomachic.— <i>Steel.</i>	.....	1 oz.	...	6 to 8 drachms.	Scraped and dried rhizome of zingiber officinalis.
Zinger, green...	Uddaruck	ရှမ်းစိမ်း ...	Carminative, stomachic.— <i>Synn.</i>	.....	...	6 to 12 tolas.	3 lbs.	Rhizome of zingiber officinalis.
Zycetine ..	.....	.....	.....	.....	...	...	...	Heileborus niger.
Jellebore(black)	Kala bitch wa.— <i>Synn.</i>	.....	Narcotic, excitant.— <i>Synn.</i>	.....	...	½ to 1 tolas	...	.....
Jemp, Indian...	Bhang or subzi (leaves of plant) (Tops ganja).	ထေးခြောက် ထင်း။	Narcotic, anodyne, anti-spasmodic, hypnotic, causes relaxation of muscular spasm, hence useful in cases of calculi which have become impacted.— <i>Steel.</i> Stimulant, tonic.— <i>Synn.</i> In tetanus, rheumatism, and rabies.— <i>Steel.</i>	.....	5 to 10 drachms.	2 to 4 tolas of bhang ½ to 2 tolas of ganja.	2 to 6 drachms of ganja; 5 to 10 drachms of bhang.	Canabis sativa, var. Indica.
Jydragyni iodidum rubrum ointment (red ointment).	.....	.....	.....	.....	...	...	...	Red mercury blister.
Joney	Shah— <i>Synn.</i> Shabad or m u d h.— <i>Steel.</i>	ပျားရည် ...	Laxative, emollient, demulcent.— <i>Synn.</i>	.....	...	...	Ad lib.	.....
Huldee ...	Huldee	နွဲ့ထက် ...	See Turmeric.	.....	...	...	...	.....
Hyoscyamus ...	Khorasani jawan.— <i>Steel.</i>	ထန်းသီး ...	Narcotic, soporific, anodyne, anti-spasmodic.— <i>Steel.</i> Sedative.— <i>Synn.</i> Cardiac, tonic.— <i>Finlay Dun.</i>	.....	1 to 2— <i>Steel.</i> 2 to 4— <i>Steel.</i>	1 to 3 tolas.	2 to 4 drachms (leaves).	Leaves and seeds (especially) of hyoscyamus niger.
Ink nuts	Kakar singi ulday.	ချောသီး ...	Tonic, astringent	.....	4 drachms; 2 to 8 tolas.	2 to 6 tolas.	...	Galls of this succinea.
Iodine	.....	.....	Tonic, alterative, resolvent, deobstruent.— <i>Fuson.</i>	.....	...	...	½ drachm.	.....
Iodine, liniment iodine ointment.	.....	.....	.....	.....	...	...	...	.....
Iodine tincture	.....	.....	.....	.....	...	...	...	.....
Iodoform	.....	.....	.....	.....	...	...	...	.....
Iodoform ointment.	.....	.....	.....	.....	...	...	...	.....
Jaggery(treacle)	Goor	.....	Nutritive, demulcent, laxative, vehicle.— <i>Steel.</i>	.....	Ad lib. ...	...	...	Molliasses.
Jinjili leaves	.....	နှမ်းရွက်	.....	.....	...	...	...	Sesamum Indicum.

List of drugs employed in the treatment of elephants, with their native names, actions, uses, and doses—continued.

Drugs.	Hindustani.	Burmese.	Uses.			Doses.			Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.		
Jinjili oil ...	Mitha tel, til ka tel, barik tel.— <i>Steel.</i>	ရဲခါးတီ ...	Substitute for olive oil: vehicle, laxative, demulcent, and emollient.— <i>Steel.</i>	Emollient, demulcent, vehicle	1 to 2 pints.	1 to 3 scers.	1 to 4 pints.	1 to 2 pints.	Fixed oil obtained by expression from the seeds of above.
Jinjili seeds ...	Tib ...	ရဲခါးတီ ...	Emmenagogue.— <i>Steel.</i> Laxative?	Excitant.— <i>Symm.</i>	...	...	...	...	...
Kerosene oil ...	Mutte ka tel.— <i>Symm.</i>	ရဲခါးတီ ...	A valuable tonic.— <i>Steel.</i> Febrifuge, anti-periodic, antihelmintic.— <i>Steel.</i>	.....	4 to 8 drachms; 2 to 6 tolas.	...	...	...	Stem with the root of <i>Picrohiza kurroa</i> .
Kootkie ...	Kutki.— <i>Steel.</i>	ရဲခါးတီ ...	.....	.....	...	...	...	...	.....
Lead acetate ...	.....	ခဲယဉ္ဇာရည် ...	Sedative, astringent, in diabetes.— <i>Tuum.</i>	.....	...	...	...	...	.....
Lead lotion ...	.....	ခဲယဉ္ဇာရည် ...	.....	Astringent, sedative, cooling to wounds, &c.	...	...	...	...	.....
Lead subacetate liquor.	.....	.....	.....	Astringent, sedative, cooling to wounds.— <i>Tuum.</i>	...	...	...	...	.....
Lemon juice ...	Nimboo ka ras	ယံပုရာရည်	Refrigerant.— <i>Symm.</i>	.....	...	4 to 6 tolas.	...	...	Goulard's extract.
Lime ...	Chuna	ထုံး	.....	Caustic, desiccant.	...	...	...	...	.....
Lime water ...	.....	ထုံးရည်	Antacid, in flatulency	.....	...	...	...	8 to 10 ozs.	.....
Linsced meal ...	Alsi-tisi	ပိက်သံဝေဝေ	Demulcent.— <i>Steel.</i> Emollient, nutritive.— <i>Symm.</i> Laxative.— <i>Tuum.</i>	Emollient, vehicle.— <i>Tuum.</i>	<i>Ad lib.</i>	2 to 12 tolas.	...	...	Seeds of <i>linum catharticum</i> .
Linsced oil ...	Alsi ka tel	ပိက်သံဆီ	Nutritive, laxative, emollient, vehicle.— <i>Tuum.</i>	Emollient, vehicle.— <i>Tuum.</i>	...	...	...	...	.....
Liquor ammonia (dilute).	.....	.....	.....	Counter-irritant	...	...	...	...	.....
Liquor ammonia acetate.	.....	.....	Mild stimulant, diaphoretic, diuretic, febrifuge.— <i>Tuum.</i>	Disiccant	...	...	...	4 ozs.	.....
Liquor arsenicalls.	.....	.....	.....	.....	...	...	...	1 to 1 oz.	Strength, 4 grains of arsenic in each ounce.

Liquorice root (country).	Mitta lakhre.— <i>Symm.</i> — <i>Jahi madh mulati.</i> — <i>Khory.</i>	နွယ်ချိုခြင်...	Tonic, nutrient.— <i>Steel, Symm.</i> Demulcent, laxative, expectorant, diuretic.— <i>Khory.</i>	Suppurative, detergent.— <i>Steel</i>	...	...	4 to 8 drachms.	Roots of glycer-rhiza glabra. <i>Steel</i> says roots of abrus precatorius is an efficient substitute. Arillus of the seeds of physalis officinalis.
Mace	Janantri ...	မာဒွိယို	Carminative.— <i>Symm.</i> Stimulant, digestive, tonic, astringent.— <i>Khory.</i>	.....	...	...	4 to 6 drachms.	Bark of Mangifera Indica.
Mango tree bark	Aam ka zad ka chhal.	သရက်ခေါက်	Tonic, astringent.— <i>Steel</i> ...	Mild astringent	...	...	...	Bark of Azadirachta Indica.
Mango seeds	Aam ka bichee	သရက်ဇေ့ ...	Kernel of the seed said to be good for expelling worms.	.....	...	...	...
Margosa bark...	Nem ka chhal	သင်္ဘောတထာခေါက်။	Tonic, astringent, antiperiodic.— <i>Steel.</i> Relieves thirst, vomiting, and nausea in fever.— <i>Khory.</i>	In skin diseases.— <i>Khory</i> ...	...	...	1 oz.	
Mangosa fruit...	.....	သင်္ဘောတထာဇေ့	Purgative, anthelmintic, emollient in urinary diseases.— <i>Khory.</i>		...	...	...
Margosa fruit oil.	Nem ka tel ...	သင်္ဘောတထာဆီ	Anti-spasmodic, antihelmintic.— <i>Steel.</i> Stimulant.— <i>Khory, Steel.</i>	In sprains and rheumatism, parasiticide, anti-inflammatory; also keeps off maggots; used for sore shanks, bruised legs, &c.— <i>Steel.</i>	...	...	...
Margosa leaves	Nem ka putta	သင်္ဘောတထာရွက်။	Vermifuge.— <i>Steel.</i> In jaundice and skin diseases, such as boils, prurigo, &c.— <i>Khory.</i>	Stimulant to ulcers and in chronic skin diseases; used as poultice.— <i>Steel.</i> Discutient; useful in dispersing indolent glandular swellings, made into a pulp; useful application to pustular eruptions, open sores and bruised joints.— <i>Khory.</i>	...	...	...	Azadirachta Indica.
Margosa tree ...	Nem ka zad...	သင်္ဘောတထာခါး။	Deodorizer; febrifuge; its vicinity ensuring freedom from specific febrile disorders.	.....	...	...	...
Margosa tree today.	Nim ka nira ...	.....	Stomachic.	.....	...	...	...
Milk	Dudh ...	နို့	Emollient, nutritive demulcent.	.....	...	...	5 to 10 lbs.	
Milk, sour	.....	နို့နုရည်	.....	.....	...	...	...
Moringa bark and roots.	Munge.— <i>Steel.</i> Sengua.— <i>Khory</i>	ခွန်သတ္တန်ခေါက် ဂုံးဆခြင်။	Stimulant, diuretic, particularly indicated in dropsy with debility.— <i>Steel.</i> In cough.— <i>Khory.</i>	Application for contusions. Promotes absorption. Stimulant to stinging wounds.— <i>Steel.</i> As poultice acts as rubefacient to reduce swellings, relieve rheumatic pains, &c.— <i>Khory.</i>	...	...	...	Moringa pterygosperma.

List of drugs employed in the treatment of elephants, with their native names, actions, uses, and doses—continued.

Drugs.	Hindustani.	Burmese.	Uses.			Doses.			Remarks.	
			Internal.	External.	Steel.	Symm.	Gilchrist.			
Moringa flowers	Sengua ka phul	သို့ထွန် ပွင့်	Tonic, diuretic; increases flow of bile.— <i>Khery.</i>	As poultice; useful in reducing glandular swellings. It always produces a blister.— <i>Khery.</i>	...	...	2 to 6 lbs.	...	1 to 4 drachms.	Seeds of sraphaba and nigra.
Moringa leaves	Shagata pan.— <i>Khery.</i>	သို့ထွန်ရွက်								
Mustard	Rai	ပုံညှင်းငှေ့ ...	Digestive, emetic in large doses.— <i>Symm.</i> Stimulant, anti-spasmodic.	Stimulant.— <i>Steel.</i> Rubefacient, counter-irritant.	...	...	1 to 4 tolas	...	4 drachms	Gum resinous exudation from the stem of Balsamo dendron myrrha.— <i>Tuson.</i>
Mustard oil	.....	ပုံညှင်းဆီ ...	Mild aperient.— <i>Khery</i>	Stimulant, anti-inflammatory, removes scurf and lice.— <i>Khery.</i>	...	...	1 to 4 tolas	...	1 to 4 drachms.	Seeds of myristic officinalis.
Myrrh	Bol.— <i>Steel.</i> Heerabole.	ရေခဲငေး ...	Stimulant and tonic.— <i>Steel</i> Expectorant.— <i>Symm.</i> In chronic cough.— <i>Tuson.</i> Astringent and detergent.— <i>Khery.</i>	Traumatic.— <i>Steel</i> and Excitant, deodorizer.— <i>Tuson.</i>	...	...	4 to 6 tolas	...	1 to 1 1/2 drachms.	Seeds of styracinaux vomica.
Nutmeg	Jaephui	ကမိဂြိုက်ဆီ	Carminative.— <i>Symm.</i> Stimulant, digestive tonic, astringent.— <i>Khery.</i>	.....	...	...	1 to 2 tolas	...	1 to 1 1/2 drachms.	Seeds of styracinaux vomica.
Nox vomica	Kuchla.— <i>Symm.</i> Kuchila.— <i>Khery.</i>	ဝေးဝါး ...	Nerve tonic.— <i>Steel</i> Stimulant.— <i>Symm.</i> Astringent.— <i>Khery.</i> In chronic rheumatism, paralysis, chronic diarrhoea and dysentery. Good vermifuge.— <i>Khery.</i>	.....	...	...	1 to 2 tolas	...	1 drachm	Oil from cinamomum zeylanicum
Oil, cinnamon	Darchini ka tel, taj ka tel.	သင်ကြဲပွဲဆီ	Stimulant. In diarrhoea.— <i>Khery.</i> Anthrax.	Stimulant, rubefacient.— <i>Khery.</i>	...	...	...	...	...	From Olea Europea.
Olive oil	.....	ယံထွန်ဆီ ...	Laxative, nutritive, emollient, vehicle.— <i>Tuson.</i>	Emollient, vehicle.— <i>Tuson.</i>	...	...	...	...	...	From Pinus palustris and others.
Oil of turpentine	Terpin tel	ထာထပြင်ဆီ	Diuretic, stimulant.— <i>Steel.</i> Astringent, diaphoretic, antispasmodic, anthelmintic, cathartic.— <i>Tuson.</i>	Stimulant.— <i>Steel.</i> Vesicant, counterirritant, digestive.	5 ozs, 2 drachms 1 oz.	...	...	...	...	Root, bark and flowers of nerium odorum.
Oleander, sweet scented.	Kanil or karbi.— <i>Steel.</i> Lal kaneri.— <i>Symm.</i>	ဆင်ကျင်းပင်	Excitant, tonic, slightly narcotic, anti-periodic; bark.— <i>Steel.</i>	In irritable and soughy wounds, bruises and burns; in form of poultice.	1 to 6 drachms.	...	...	...	...

Onions	Peaz	ကြက်ထွန်နီ...	Digestive, diuretic, has more action on kidneys than garlic; may be given to animals exposed to a chill; stimulant.— <i>Sieel</i> . In colic.— <i>Khory</i> .	When roasted its poultice applied to inflamed and indurated boils.— <i>Khory</i> .	8 lbs. (<i>Parakeri</i>)	1 to 3 seers	1 to 5 seers	10 lbs.	Bulb of alicium cepa.
Opium	Afteen	တိန်း	Narcotic anodyne.— <i>Sieel</i> . Stimulant, sedative, anti-spasmodic.— <i>Turon</i> .	Anodyne	1/2 to 1 oz.	1/2 to 4 tolas	...	2 drachms to 1 oz.	Papaver somniferum.
Opium, tincture	Afteen ka arak	တိန်းရည်	Anodyne, hypnotic, sedative anti-spasmodic.— <i>Turon</i> .	Anodyne. In enemata in diarrhoea.	...	...	...	3 ozs. ...	Landanum.
Papaw tree leaves.	Papaya.— <i>Sieel</i> Papaya ka putta.— <i>Khory</i> .	သင်္ဘောရွက်	.....	The remedy par excellence in capped elbow and other fibrous tumours; detergent.— <i>Sieel</i>.	...	...	...	...	Cartea papaya.
Papaw tree juice	.....	သင်္ဘောရေ	Vermifuge, especially for lumbrici.		3 drachms for horses. May be tried in same dose.	1 to 8 tolas	...	1/2 oz. to 6 drachms.	Berries of piper nigrum.
Pepper, black	Kali mirchi	ငရုတ်ကောင်း	Stimulant.— <i>Sieel</i> . Carminative.— <i>Slymm</i> . Stomachic, aromatic.— <i>Turon</i> . Resolvent, tonic, anti-periodic.— <i>Khory</i> .	In obstinate ulcers; combined with onions.— <i>Sieel</i> , <i>Gilchrist</i> .	1/2 to 2 ozs.	1 to 8 tolas	1/2 to 3 ozs.	1/2 oz. to 6 drachms.	Eruit of piper longus.
Pepper, long	Pipice	ပိတ်ချင်း	Tonic, carminative, stomachic.— <i>Slymm</i> . Stimulant, in debility.— <i>Sieel</i> . Gilchrist recommends it in gunnuss and chourung. In chronic cough.— <i>Khory</i> .	Antiseptic, disinfectant, and deodorizer.	.....	.....	1 lb. ...	...	Mentha piperita.
Peppermint	Pudina	.....	Carminative.— <i>Sieel</i> . In diarrhoea, debility and colic.— <i>Gilchrist</i>.	.....	.....	.....	.....	.....	.....
Phenyle	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pimenta	.....	.....	Aromatic, carminative, stomachic, anti-spasmodic. In indigestion, flatulency, and colic.— <i>Turon</i>.	.....	.....	.....	.....	.....	.....
Piper cubeba	Cabaub chinee.— <i>Sieel</i> . Sital chini.— <i>Khory</i> Kit Alkaira	.....	Carminative, excitant.— <i>Slymm</i> . Specially valuable in cases of calarrh in small doses.— <i>Sieel</i> .	Useful for foot sores.— <i>Sieel</i> . Excitant, rubefacient, antideodorizer, anti-parasitic.— <i>Turon</i> .	1/2 to 1 oz.	1 to 8 tolas	.....	.....	Dried unripe berries of Eugenia pimenta.— <i>Turon</i> .
Pis liguida	.....	ကတ္တရာရေ	.....	.....	.....	.....	.....	.....	Fruits of cubeba officinalis.
Plantain	Monz; kela.— <i>Sieel</i> .	ရွက်ပျောသီး	In muth, urinary disorders, nutritive.	.....	6 to 12 lbs.	.....	.....	Ad lib ...	Fruit of musa paradisiaca.
Plantain tree root.	Monz ka jud	ရွက်ပျောမြစ်	Diaphoretic.— <i>Slymm</i>	.....	.....	3 to 8 seers.	.....	.....	.....

List of drugs employed in the treatment of elephants, with their native names, action, uses, and doses—continued.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.			Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	
Plantain tree leaves, Poppy capsules	Monz ka putta Posht	၄၀၅၂၅၂၀၇ ပိန်းသေသံ	..... .....	Eye-shades, &c. Anodyne as fomentations of poultice to bruised and inflamed parts, or to tender and irritable ulcers, or to eyes in ophthalmia.— <i>Khery</i>.	...	...	...	Capsules of Popaver somniferum.
Potass. bicarbonate.	.....	.....	Anti-acid, diuretic	.....	...	...	...	4 to 6 drachms.
Potass. chlorate	.....	.....	Mild stimulant, diuretic, refrigerent, in flatulency chiefly.— <i>Tuson</i>.	.....	...	...	...	2 to 4 drachms.
Potass. bromide	.....	.....	Sedative; lowers generative functions in a marked degree.	.....	...	...	...	4 to 6 drachms.
Potass. nitras	Shora.— <i>Steel</i>	ယန်းပိန်း	Diuretic, febrifuge, refrigerent.— <i>Steel, Slymm</i> .	Refrigerent.— <i>Steel</i> . Stimulant to unhealthy wounds.— <i>Tuson</i> .	½ to 1 oz.	1 to 3 tolas	...	½ to 1 oz.
Potass. permanganas.	.....	.....	.....	Deodorizer, disinfectant, exsiccant to unhealthy wounds.— <i>Tuson</i>.	...	...	...	...
Potass. permanganas liq.	.....	.....	.....	Cleansing wash for diseased surfaces.— <i>Tuson</i> . Disinfectant, deodorizer.	...	...	...	...
Potass. iodidi	.....	.....	Alterative, deobstruent, diuretic; in articular rheumatism, dropsy and enlargement of lymphatic glands.— <i>Tuson</i> .	Promotes absorption of tumours and other abnormal growths.	...	...	...	2 drachms
Potass. acetate.	.....	.....	Same as nitrate, diuretic.— <i>Finlay Dun</i>.	.....	...	...	...	2 to 3 drachms.
Pomegranate fruit.	Anar darum.— <i>Khery</i> .	သဝဲသီးပွန်	Astringent.— <i>Steel</i> . Vermifuge, stomachic.— <i>Khery</i> . In chronic diarrhoea and dysentery.	.....	...	...	...	6 drachms to 3 oza.
Pomegranate root, bark.	.....	သဝဲပွဲခေါက်	Anthelmintic for tenia.— <i>Steel</i> . Specific in tapeworms.— <i>Khery</i>.	.....	...	...	...	2 to 6 tolas

Sweet flag	Bech, butch or goor butch.— <i>Steel</i>.	.....	Stomachic, aromatic, anti-periodic, tonic, stimulant.— <i>Steel</i>.	.....	In chronic rheumatism. Anti-parasitic, for fleas.	$\frac{1}{2}$ to 1 oz.	.....	.....	Rhizome of acorns Calantula.
Tar ointment	.....	ကတ္တလောဝေပ	.....	.....	For cracks and foot dressing.	.....	.....	.....	.....
Tamarind pulp	Ambli.— <i>Steel</i> . Imhli.— <i>Shery</i> .	ထောင်းချက်။ မန်ကျည်းသီး	Laxative.— <i>Steel</i> . Refrigerant.— <i>Steel</i> . <i>Slymm</i> . Diuretic.— <i>Steel</i> . <i>Slymm</i> . Cooling aperient.— <i>Slymm</i> . Vehicle. Antibilious, anti-scorbutic, carminative, digestive, quenches thirst.— <i>Shery</i>. .....	.....	Antiseptic, disinfectant.	6 ozs. ...	6 to 12 tolas.	.....	Ripe fruit of Tamarindus Indica.
Thymol	.....	ထေးရွတ်ရည်	Antidote to nux vomica; strychnia.	.....	ditto.	.....	.....	.....	.....
Tobacco decoction.	.....	ထေးရွတ်	Sedative, anodyne, valuable in cases of stragury of urine and obstinate spasm of the bowels. In tetanus, colic; relieves constipation.— <i>Steel</i> . Narcotic, purgative.— <i>Slymm</i>. .....	.....	Anodyne, especially useful in allaying cutaneous furor.	.....	$\frac{1}{2}$ to $\frac{3}{4}$ tola.	1 to $\frac{3}{4}$ drachma.	Nicotiana tabacum.
Tobacco leaves	Tumbakoo	.....	.....	.....	.....	.....	.....	.....	.....
Tobacco infusion.	.....	ထင်ဟဲ	Laxative, vehicle, hastens activity of cathartics.	.....	.....	.....	.....	.....	Molasses.
Treadle	Goor	.....	.....	.....	.....	.....	.....	.....	.....
Turmeric	Holdce	နွံရွတ်တက်	Aromatic, stimulant, mild tonic.— <i>Steel</i>.	.....	Purges of burning turmeric useful as an inhalation in catarrh and a decoction has a beneficial effect in ophthalmia.— <i>Steel</i>. .....	.....	.....	.....	Rhizome of Curcuma longa.— <i>Steel</i> .
Ujwan of Ajwan, three kinds	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ujwan of Oman	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ujwan of Shore.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ujwan of Khora.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ujwan.	Ajmayan.— <i>Steel</i>.	.....	Stimulant, aromatic, tonic, especially useful in diarrhoea and indigestion with flatulence.— <i>Steel</i> . Carminative, stomachic.— <i>Slymm</i> . Antispasmodic.— <i>Shery</i> . In colic, bronchitis. Tonic, astringent.— <i>Fuzon</i> <i>See</i> Acetum. ....	.....	.....	.....	.....	.....	.....
Verdigris	Zangar	ထင်ဟဲကျည်းညို	.....	.....	Stimulant to wounds.— <i>Steel</i> . Escharotic.— <i>Slymm</i>......	.....	.....	.....	.....
Vinegar	Sirka	.....	.....	.....	.....	.....	.....	.....	.....
Wax	Mom	စရောင်	.....	.....	Adhesive.— <i>Steel</i> . Emollient. .....	.....	.....	.....	Cupri subacetat.

APPENDICES.

USES OF DRUGS EMPLOYED IN THE TREATMENT OF DISEASES, WITH THEIR NATIVE NAMES, ACTIONS, USES, AND DOSES—CONCLUDED.

Drugs.	Hindustani.			Burmese.			Uses.			Doses.			Remarks.	
	Geong ha atta...	Internal.	External.	Steel.	Symm.	Gichtriet.	Steel.	Symm.	Gichtriet.					
Wheat flour ... Zinc carbonate, Eq.	Geong ha atta...	Vehicle, nutritive ........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........
Zinc oxide ... Zinc ointment...	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....	..... .....
Zinc sulphate ... Zinc, lotion	Soiled tuba— Steel.	Astringent, tonic ........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........	..........

Sir William Bur-
nett's disinfecting
fluid contains 200
grains to the ounce.

Ad lib.
" "
2 to 4
drachms.

Caustic, astringent, deodorizer,
disinfectant; stimulant to
wounds, unhealthy ulcers, in
eczema.
Desiccant, astringent.
Astringent. In slight ex-
coriations and ulcerations.—
Fibros.
.....
Astringent, escharic, mild es-
charotic, and desiccant when
applied to wounds. Collyri-
um injected into sinuses
and in quins according to
strength used.

INTERNAL REMEDIES AND EXTERNAL APPLICATIONS, ALSO A NUMBER OF FORMULÆ FOR MUSSAULS, &c.

Internal remedies.

Anodynes.—Agents employed to allay or diminish pain, and of these opium is the most useful—

- | | | | | |
|-----------------|--------------|----------|----------------|-----------------------------|
| (1) Opium | may be given | in doses | from 2 drachms | up to 1 ounce. |
| (2) Indian hemp | ... | { Bhang | ... | ... 5 to 10 drachms. |
| | | { Ganja | ... | ... 2 to 6 drachms. |
| (3) Dhatura | ... | { Seeds | ... | ... 2 to 4 drachms. |
| | | { Leaves | ... | ... 4 drachms to 1½ ounces. |
| (4) Henbane | ... | ... | ... | ... 2 to 4 drachms. |
| (5) Opium | ... | ... | ... | ... 3 drachms. |
| Camphor | ... | ... | ... | ... 4 drachms. |

Any of the above in doses regulated in accordance with the severity of the case may be added to other medicines, namely, cardamoms, nutmeg, cloves, assafœtida, but must be repeated with caution, that is, half doses every three or four hours.

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|------------------------|-----|-----|-----|--------------|
| (6) Laudanum | ... | ... | ... | 3 ounces. |
| Sweet spirits of nitre | ... | ... | ... | 3 ounces. |
| Water | ... | ... | ... | sufficiency. |

Soaked in bread or boiled rice.

Astringents are drugs which aid in checking secretions such as diarrhœa and dysentery—

- | | | | | |
|--------------------|-----|-----|-----|---------------------------|
| (7) Opium | ... | ... | ... | 3 drachms. |
| Powdered catechu | ... | ... | ... | 6 drachms. |
| Powdered cardamoms | ... | ... | ... | 4 drachms. |
| Powdered chalk | ... | ... | ... | 2 to 4 ounces (mix well). |

Every four hours if necessary.

- | | | | | |
|-----------------|-----|-----|-----|------------------------|
| (8) Opium | ... | ... | ... | 3 drachms. |
| Acetate of lead | ... | ... | ... | ½ to 1 drachm. |
| Powdered ginger | ... | ... | ... | 6 drachms to an ounce. |

Twice a day.

- | | | | | |
|--------------------|-----|-----|-----|------------|
| Sulphate of copper | ... | ... | ... | 1 drachm. |
| Or powdered alum | ... | ... | ... | 2 drachms. |

May be used in lieu of the lead.

Oak galls in doses of 2 to 4 drachms, or gallic, or tannic acid, in doses of 1 drachm, may be added to, or substituted for, one or more of the ingredients in the above prescriptions, the opium being retained.

- (9) Pomegranate peel powdered, in doses of 6 drachms to 3 ounces, is also a good astringent.
Bael fruit is very useful, as also is solution of gum arabic.
- | | | | | |
|--------------------|-----|-----|-----|-----------------------|
| (10) Opium | ... | ... | ... | 2 to 4 drachms. |
| Galls | ... | ... | ... | 2 drachms. |
| Pimento, or nutmeg | ... | ... | ... | 4 drachms. |
| Carbonate of soda | ... | ... | ... | ½ ounce (mix.)—Tuson. |

Once or twice daily.

Carminatives, cordials, or digestive tonics.—Warm stimulating drugs generally possessing an agreeable taste and odour, such as aromatic seeds, spices. They dispel flatus, allay griping, temporarily restore exhausted strength and rouse the system. They are generally given mixed with ghee, jaggery, by mahouts, under the name of mussauls. They are also beneficial combined with stimulants, rum, brandy, especially to an animal suffering from cold and fatigue.

The more important are turmeric, garlic, cardamoms, nutmeg, cinnamon, coriander, aniseed, ginger, caraway, allspice, cloves, mace, cummin, mustard seeds, long pepper, black pepper, fennel, fenugreek, liquorice, and assafœtida. Dose $\frac{1}{2}$ an ounce, once or twice a day. Capsicum is useful in doses from $\frac{1}{2}$ to $1\frac{1}{2}$ drachms.

It has already been noted that though useful when occasion arises their indiscriminate employment is undoubtedly a source of much mischief.

- | | | |
|-----------------------|-----|---|
| (11) Powdered aniseed | ... | } $\frac{1}{2}$ an ounce of each, to be well mixed. |
| Powdered cardamoms | ... | |
| Powdered gentian | ... | |

Once or twice a day.

- | | | |
|----------------------------|-----|--|
| (12) Powdered caraway seed | ... | } $\frac{1}{2}$ an ounce of each, mixed. |
| Powdered cinchona bark | ... | |
| Powdered ginger | ... | |

Once or twice a day.

- | | | |
|----------------------------|-----|--|
| (13) Powdered black pepper | ... | } $\frac{1}{2}$ an ounce of each, mixed. |
| Powdered chiretta | ... | |
| Powdered liquorice | ... | |

Once or twice a day.

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|--------------------------|-----|--|
| (14) Bicarbonate of soda | ... | } $\frac{1}{2}$ an ounce of each, mixed. |
| Chiretta | ... | |
| Caraway seed | ... | |

Once or twice a day.

- (15) Fatigue brandy, rum or whisky, with powdered cloves or nutmeg and a little water.

Soaked in bread or mixed with boiled rice.

Diuretics.—Agents which promote the action of kidneys, causing an increased secretion and discharge of urine.

- | | | | |
|------------------------|-----|-----|-----------------------------|
| (16) Nitrate of potash | ... | ... | $\frac{1}{2}$ ounce. |
| Powdered resin | ... | ... | 1 to $1\frac{1}{2}$ ounces. |
| Bar soap | ... | ... | 1 ounce. |

To be well mixed and given with jaggery.

- | | | | |
|----------------------------|-----|-----|-----------------|
| (17) Bicarbonate of potash | ... | ... | 4 to 6 drachms. |
| Rum or gin | ... | ... | 8 ounces. |
| Water | ... | ... | Sufficiency. |

Especially useful in feeble animals.

(18)	Sweet spirits of nitre	...	in 3-ounce doses, with water.
(19)	Vinegar	...	4 ounces, well diluted.
(20)	Sour milk	...	} of each 10 pounds.
	Boiled rice	...	
	Onions	...	
	Green ginger	...		1 pound.

Give once a day if necessary for two or three days.

(21)	Oil of turpentine	...	2-ounce doses, mixed with white of egg or gruel, but must not be used when the kidneys are affected.
(22)	Radishes	have a diuretic action.	Dose 6 to 24 pounds.

The bark, root, and seeds of the common moringa or drumstick fruit tree may be given in doses of 1 to 4 pounds.

Laxatives or aperients.—Agents which act gently on the bowels.

(23)	Tamarind pulp	...	} of each 8 ounces.
	Common salt	...	
(24)	Castor, or Linseed oil	...	} 1 to 1½ pints.
(25)	Tamarind pulp	...	
	Salt	...	2 ounces.
	Cassia pulp	...	8 ounces.
	Sweet oil	...	1 ounce.
	Sweet oil	...	8 ounces.
	Cummin	...	1 ounce.

Mix and put the whole in a tender plantain leaf and give.—*Steel.*

(26)	Tamarind pulp	...	6 ounces.
	Epsom salts	...	10 to 12 ounces.
(27)	Sublimed sulphur	...	3 ounces.
	Jaggery	...	A sufficiency.
(28)	Clarified butter or ghee	...	1 to 2 pounds.

Mixed with honey or jaggery.

Purgatives.—Purgatives are medicines which cause evacuation of the bowels; the milder are called laxatives or aperients. Mahouts are much averse to the use of purgatives.

Purgatives often cause severe griping pains; in order to correct this they are usually combined with some warm aromatic drugs such as aniseed, ginger, coriander, cardamoms, caraway seeds, allspice, &c., in doses of half an ounce and more.

Henbane leaves may be used with the same object, combined with aloes, colocynth, &c., in drachm doses.

Barbaloin is the active principle of Barbadoes aloes; it is claimed that its action is more rapid and safer, and it has the great advantage of being *tasteless and odourless, and also does not gripe*. Its strength is said to be two and a half times that of Barbadoes aloes, that is, that 1 drachm equals about 2½ drachms of aloes. The only thing against it is that it is expensive: it is nevertheless, being a tasteless drug, well worthy of extensive trial.

(29)	Common or Epsom salts	...	...	1 pound.
(30)	Cassia pulp	...	...	1 to 3 ounces
(31)	Cassia leaves (senna)	...	...	1 to 3 pounds.
* (32)	Croton oil	...	...	30 to 40 drops.
	Castor oil	...	...	8 ounces.
(33)	Tamarind pulp	...	...	1 pound.
(34)	Custard-apple leaves	...	...	100 to 250.
(35)	Aloes, Barbadoes	...	...	8 drachms.
	Calomel	...	...	1 drachm.
(36)	Colocynth	...	...	The dried peeled fruit free from seeds, or the pulp, from 4 to 6 drachms. As it may cause severe griping, it should be combined with a drachm or two of powdered henbane. Especially useful when the liver is out of order.
(37)	Aloes	...	...	4½ to 6 drachms.
	Croton seeds	...	...	2½ to 4½ drachms.
	Jaggery	...	...	A sufficiency.

Or, nine drachms of croton seeds alone may be given, and repeated the following day if the animal refuses to take aloes.—*Hawkes.*

(38)	Croton seeds	...	...	1 ounce.
	Calomel	...	...	1½ drachms.
	Aloes	...	...	6 drachms.

Make into a ball with rice flour and jaggery.—*Forsyth.*

Tonics.—Agents which gradually improve the condition and functions of the digestive organs so as to enable the system to acquire increased tone and vigour. Tonics should be continued for some time. Iron and arsenic are two of the most valuable.

Arsenic must only be given *after* food, and it is also desirable to only give it for a week or ten days at a time, after which it should be discontinued for four days or so, some other tonic being substituted during this period.

Liquor arsenicalis is tasteless and readily taken mixed in a bucket of water. Strength: an ounce of liquor arsenicalis contains four grains of arsenic.

(39) Liquor arsenicalis.

Dose ½ to 1 ounce daily.

(40)	Arsenic	...	...	2 grains.
	Nux-vomica (powdered)	...	...	1 drachm.
	Gentian or chiretta (powdered)	...	...	½ ounce.

Once or twice a day.

(41)	Sulphate of iron	...	...	2½ drachms.
	Cinchona bark (powdered)	...	...	4 drachms.
	Ginger	...	...	6 drachms.

Once or twice a day.

- | | | | | | |
|---|--|-----|-----|-----|------------------|
| (42) | Carbonate of iron | ... | ... | ... | 2 drachms. |
| | Sulphate of quinine | ... | ... | ... | 1 drachm. |
| | Extract of nux-vomica | ... | ... | ... | 10 grains. |
| | Caraway seed | ... | ... | ... | 2 drachms. |
| Once or twice a day. | | | | | |
| (43) | Sulphate of copper | ... | ... | ... | 1 to 1½ drachms. |
| | Cinchona bark (powdered) | ... | ... | ... | ½ ounce. |
| | Aniseed | ... | ... | ... | ½ ounce. |
| Once daily. | | | | | |
| (44) | Nim or mangosa bark, powdered (Tama-akauk) | ... | ... | ... | 1 ounce. |
| | Ginger | ... | ... | ... | ½ ounce. |
| (45) | Holarrhena antidysenterica (seeds) | ... | ... | ... | 4 drachms. |
| | Gentian | ... | ... | ... | 4 drachms. |
| Twice a day. | | | | | |
| (46) | Embelia ribes (berries) | ... | ... | ... | 6 drachms. |
| | Ginger | ... | ... | ... | 4 drachms. |
| Once daily. | | | | | |
| Vermifuges. —Agents which kill, expel, or prevent the return of worms. | | | | | |
| Before administering these remedies an animal should be allowed short ration for some few hours beforehand and for some hours after. These preparations will require repetition every now and again. | | | | | |
| After expulsion of worms, good food, wheaten cakes, gruel, boiled rice and salt must be given to keep up the animal's strength, and the same treatment must be adopted during convalescence, when tonics should be given. | | | | | |
| (47) | Daily administration of salt | ... | ... | ... | 1½ to 2 ounces. |
| (48) | Tartar emetic | ... | ... | ... | 2 drachms. |
| | Sulphate of iron | ... | ... | ... | 2 drachms. |
| | Aniseed | ... | ... | ... | ½ ounce. |
| Once daily for four or five days, after which a purgative should be given. | | | | | |
| (49) | Powdered black salt | ... | ... | ... | 2½ ounces. |
| | Sulphate of iron | ... | ... | ... | 2½ drachms. |
| | Chiretta | ... | ... | ... | 1 ounce. |
| Once a day. | | | | | |
| (50) | Assafœtida | ... | ... | ... | 1 ounce. |
| | Calomel | ... | ... | ... | 1 drachm. |
| | Aniseed | ... | ... | ... | ½ ounce. |
| Once daily for a few days, followed by a purgative. | | | | | |
| (51) | Powdered seeds of the <i>Butea frondosa</i> (Pouk bin) | ... | ... | ... | 4 or 5 drachms. |
| Once daily for three or four days, followed by a purgative. | | | | | |
| (52) | Pomegranate peel (Thalai-thi-akhun) | ... | ... | ... | 1 to 2 ounces. |
| Once daily. | | | | | |
| (53) | Holarrhena antidysenterica | ... | ... | ... | 4 drachms. |
| | Bdellium (myrrh) | ... | ... | ... | 4 drachms. |
| | Catechu | ... | ... | ... | 1 ounce. |
| | Common salt | ... | ... | ... | 5 ounces. |
| | Water | ... | ... | ... | 1½ pints. |
| Mix and give as a draught.— <i>Steel.</i> | | | | | |

The papaya fruit and leaves may be given. Steel and Khory state that it is a good vermifuge for round worms.

External applications: Blisters.—Blisters are substances which when applied to the skin cause irritation, raise it, and give rise to blebs containing an amber coloured watery looking secretion.

Objects for which used.—(1) To raise the vigour of the circulation of the affected part by establishing a degree of irritation or inflammation of the skin.

(2) To stimulate the absorbent vessels of the part, and by so doing cause removal of effused fluids.

Instructions on their use.—(a) Never apply a blister to an abraded surface or to a part when inflammation, that is, heat, pain, and tenderness exist. Wait till all inflammation has been subdued through the agency of other means.

(b) When the blister has acted wash off with soap and tepid water, then apply vaseline or sweet oil to the surface.

(c) Never apply a blister at the bend of a joint. If desirous to apply one in the vicinity of a joint, it is necessary to protect the bend by first smearing plain vaseline or lard into it.

When using fluid blistering agents place a little cotton wool below the part to be blistered to absorb the drip. Apply with a brush, or dab on with a cloth.

The size of the blister will depend on the condition to be treated. On the loins, for the kidneys, or injury, it may be a foot square on each side. Around sores, a ring is applied 2 or 3 inches broad close to the wound, but so as not to enter it. The blistered surface should be covered over with a piece of paper or cloth and protected with a rug to prevent the animal getting his trunk or tail smeared with any of the blistering agents. The mahout should remain with the elephant till blister has acted and been washed off.

(54) Croton oil	...	...	...	2 drachms.
Oil of turpentine or soap liniment	...	...	...	1 $\frac{1}{2}$ to 2 ounces.
(55) Red iodide of mercury	...	...	...	1 part.
Lard, vaseline, or ghee	...	...	...	8 to 12 (1 to 8 is a very strong blister); 1 to 16 mild.
(56) Powdered cantharides (Spanish fly)	...	...	...	1 ounce.
Oil of turpentine	...	...	...	2 ounces.
Methylated spirit	...	...	...	1 pint.

Mix and allow to digest for a fortnight, occasionally stirring, then strain. Never to be applied to the loins. Useful blister.

Caustics are corrosive applications which by chemical action destroy tissues to which they are applied, and are used in foul ulcerated surfaces, spreading inflammations, or to keep down proud flesh.

Strong caustics.

(57) Hot iron, rarely used on elephants.

(58) Nitrate of silver (lunar caustic)—used in pencil as a solid.

The affected tissues are gently rubbed with the stick, which must, like other solid caustics, be held in paper or a caustic-holder.

(59) Sulphate of copper (blue-stone)—similarly applied.

(60) Carbolic acid	...	...	...	1 part.
Water	...	...	...	3 parts.

Milder caustics.

(61) Nitrate of silver	...	...	...	5 to 15 grains.
Water	...	...	...	1 ounce.

(62) Sulphate of copper	..	...	...	10 to 30 grains.
Water	...	...	...	1 ounce.

(63) Chloride of zinc	...	...	...	1 to 3 grains.
Water	...	...	...	1 ounce.

Dusting powders are dry applications used to protect raw surfaces and reduce discharges. The drugs are generally mixed with precipitated chalk, starch, or fine flour.

(64) Iodoform	...	...	...	1 part.
Starch	...	...	...	3 parts.

(65) Alum (powdered)	...	...	...	1 drachm.
Charcoal	...	...	...	4 drachms.
Chalk	...	...	...	1 ounce.

especially used when there is a foul odour..

(66) Boracic acid (powdered).

(67) Oxide of zinc } equal parts.
Starch

(68) Powdered catechu.

(69) Powdered aloes.

Iodoform, one part, may be added to three parts of any of the above and will tend to keep away flies. Lint, gauze, tow, cotton, wool, medicated with antiseptics such as carbolic acid, boracic acid, corrosive sublimate, eucalyptus, iodoform, are largely employed in dressing and protecting wounds from air, dirt, &c. Carbolyzed tow is inexpensive and most useful.

Embrocations or liniments are local agents used for stimulating the skin and subjacent parts, in sprains, enlarged glands, &c., and require to be rubbed into the affected parts for ten to fifteen minutes once or twice a day.

Solution of ammonia, which is much used in the preparation of embrocations, is made as follows :—

Liquor ammonia (fort)	...	...	1 part.
Water	...	...	2 parts.
(70) Solution of ammonia	...	...	1 ounce.
Olive or sweet oil	...	...	2 ounces.

Mix and shake well

(71)	Solution of ammonia	} equal parts.
	Olive oil	...	...	...
	Oil of turpentine	...	...	...

Shake the oil and ammonia together well, and then add the turpentine and shake again.

Compound liniment of camphor.

(72)	Camphor	...	...	...	1 ounce.
	Methylated spirit	...	...	...	4 ounces.
	Olive or sweet oil	...	...	...	1 pint.
	Solution of ammonia	...	...	...	2 ounces.

Dissolve the camphor in the spirit, shake the olive oil with the ammonia, and mix well.

Compound soap liniment.

(73)	Soft soap				4 ounces.
	Camphor				1 ounce.
	Methylated spirit				2 pints.
	Solution of ammonia				$\frac{1}{2}$ pint.

Dissolve the soap and the camphor in the spirit, then add the ammonia and strain for use.

(74)	Oil of turpentine	} equal parts.
	Mustard oil	

Liniments.

(75)	Mustard mixed with warm water (not boiling) and made into a thin paste.
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Anodyne for pain.

(76)	Laudanum	1 part.
	Soap liniment	3 parts.

Enemas or clysters, are liquids thrown into the rectum by means of an instrument, and the one recommended is Read's patent, with a specially long nozzle (that is, two feet). The gum-elastic tubing does not last in this climate, but rubber tubing can be attached easily and will answer the purpose very well, or an enema funnel can easily be made (*see* Fig. 34). It consists of a tin funnel. The bend is usually made of copper, into which is fixed a wooden pipe.

Objects for which they are used:—

- (a) To bring about an evacuation or emptying of the bowels.
- (b) To allay pain in the bowels, or adjacent organs such as the kidneys and bladder.
- (c) To introduce medicinal substances when from any cause they cannot be given by mouth.

Instructions for their use :—

Posture.—The animal must be made to assume the crouching posture he does while being loaded, but if possible the fore-quarters should be lower than the hind-quarters. A sloping ground will answer this purpose. The tail must be held on one side or right up by a man standing on the back.

(a) In order to evacuate the bowels a large quantity (many quarts) must be thrown up. The procedure is as follows : As much dung as can be reached must be removed by the hand first of all, then the pipe of the syringe previously anointed with some lubricant (vaseline or any sweet oil) must be passed gently a foot or more into the bowel ; this requires no force, but gentle manipulation. If force is used there is danger of injuring the bowel wall, and the creature is induced to strain down, which is just what is not desired at this time. The pipe having been inserted, warm water and soap, or plain water, is to be injected without force, and continued till the animal can contain no more, evinced by obvious discomfort. For producing evacuation of the bowels enemas are most useful in elephant practice ; they are to be preferred in most cases to internal remedies, producing the desired result in a much shorter time, with less pain, and at all times where the possibility of obstruction exists they are the only safe means to be employed. Again, no constipation ensues, which is almost an invariable sequel to internal remedies.

(b) In this instance it is not desired to bring about an evacuation but merely to bring hot water into contact with the parts with the object of allaying pain. Hence, to do good this must be retained, and to effect this, not more than four quarts must be injected at a time. Should this be returned, a smaller bulk must again be thrown up and this can be repeated every half-hour till pain is relieved. For this purpose water alone must be used and should be injected at a temperature of 105° as nearly as possible (not higher). The hand will bear this without discomfort. If less, the value of the enema is diminished.

(c) Is administered like (b), that is, with the object of being retained. Medicines are added to the enema to effect various objects, *e.g.*, relief of pain, killing parasites.

In procedure (a) the following may be added where ordinary simple enemas are not effectual :—

Constipation.

(77) Castor-oil	...	...	...	1 pint.
Bicarbonate of soda	...	...	...	4 drachms.
Soap, soft	...	...	...	1 ounce,

Mix well with some warm water.

(78) Turpentine up to four or five ounces beaten up with the whites of three or four eggs, and added to one pint of gruel or starch, and well mixed with warm water.

(79) Powdered aloes	...	...	...	1 ounce.
Bicarbonate of soda	...	...	...	$\frac{1}{2}$ ounce.
Boiling water	...	...	...	4 quarts.

When cool enough, inject.

(80) Salt or Epsom salts	...	...	...	10 to 12 ounces.
Warm water	...	...	...	1 gallon.

Wind, as in flatulent colic.

(81) Assafœtida	...	...	...	1 to $1\frac{1}{2}$ ounces.
Soft soap	...	...	...	$\frac{1}{2}$ ounce.
Warm water	...	...	...	3 to 4 quarts.

In procedure (c).

Pain or diarrhoea.

(82) Powdered opium	...	...	...	$\frac{1}{2}$ to 1 ounce boiled in water, to which add thin arrowroot, rice, or starch gruel.
(83) Laudanum	...	...	...	2 to 4 ounces.
Starch or gruel	...	...	...	3 quarts.

Six or eight poppy-heads well boiled in water, after which add three quarts of rice gruel or starch.*

Parasites (*Ascaris lonchoptera*.)

(85) Common salt	4 ounces, to 2 quarts of warm water.
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Daily.

(86) Oil of turpentine	4 ounces.
Sweet oil	1 pint.
Soft soap and warm water	2 to 3 quarts.

Alternate days.

* The starch should be mixed with very hot water, when it swells up into a thick gruel, and when cool enough is added to enemas.

Stimulants.

As a stimulant if animal is very weak.

- (87) Rum, brandy or whisky, eight ounces beaten up with six eggs.
Starch gruel 2 quarts.

Repeat as required.

or

- (88) Sulphuric æther 2 or 3 ounces.
Water 2 quarts.

Eye washes.

- (89) Sulphate of copper 1 grain.
Water 1 ounce.
(90) Nitrate of silver 1 grain.
Water 1 ounce.
(91) Sulphate of zinc 1 grain.
Water 1 ounce.
(92) Borax 10 grains.
Water 1 ounce.
(93) Alum 4 grains.
Water 1 ounce.

A small quantity to be syringed gently into the eye three or four times a day. Weak solutions as the above can do no harm.

Pain.

- (94) Extract of belladonna 5 grains.
Water 1 ounce.

This may be added to any of the above in this strength, that is, 5 grains of extract of belladonna to the ounce.

- (95) Extract of belladonna 2 drachms.
Water 1 drachm.
Glycerine $\frac{1}{2}$ ounce.

Rub the extract down with water, then add the glycerine and mix well together. This may be applied by rubbing it into the skin around the eye.

Eye ointments.

- (96) Yellow oxide of mercury 1 to 3 grains.
Vaseline 1 drachm.

A small quantity about the size of a split pea is inserted under the upper lid.

Eye powder.

- (97) Calomel, a few grains on a camel's hair brush flicked into the eye once daily.

Fomentations are local applications of hot water with the object of relieving pain. They may be employed over small areas such as the eye, or extensive areas such as the back. Several gallons of water must be kept heated and when a large surface is to be fomented such as the belly or chest a large common, or cooly, blanket furnished with six ropes, one attached to each corner and one at the centre of each short side, long enough to meet and be secured over the back, is the best method.

Fomentations may be applied in two ways, either (*a*) by first soaking the blanket in water so hot that the hand just bears it, wringing it out thoroughly and applying to the part at once and tying it over the back, a second dry blanket or tarpaulin being placed so as to envelop it and thus retain the heat; or (*b*) as Hawkes recommends, by first securing the *cumbly* or blanket dry, with a layer of straw placed between it and the body. Hot water that the hand will just bear is poured continuously from both sides. A large quantity of water is requisite. Other parts such as limbs, may be similarly enveloped with pieces of blanket of suitable size. The success of all fomentations depends on the degree and retention of heat: if the water be too hot, the skin may be scalded, and if not hot enough it is useless in allaying pain. In order to maintain heat the blanket should be changed at least every ten minutes until the pain is allayed. Every preparation should be ready, so that the blanket may be clapped on immediately it is wrung out, and to do this satisfactorily it is desirable to have at least two blankets in use. The relief of pain locally may be supplemented by sprinkling over the first blanket two or three tablespoonfuls of turpentine; this may be repeated once or twice during the day. When the last fomentation is withdrawn it is necessary to guard against chill by covering the fomented area with a dry blanket for some hours, or by rubbing the part till thoroughly dry, after which some mild liniment may be applied. At times pain is so severe or deeply seated, or the patient so troublesome to deal with, that local efforts are of little avail and recourse must be had to internal remedies.

Injections are medicines thrown by means of a syringe into cavities such as abscesses or sinuses to promote healing or for purposes of cleanliness.

(98) Tincture of iodine	1 to 2 drachms.
Water ...	1 pint.
(99) Nitrate of silver	2 to 3 grains.
Water ...	1 ounce.
(100) Chloride of zinc	2 grains.
Water ...	1 ounce.

(101)	Sulphate of zinc	...	...	...	2 to 5 grains.
	Water	...	...	...	1 ounce.
(102)	Alum	...	...	...	5 grains.
	Water	...	...	...	1 ounce.

Lotions are medicines employed in solution for various purposes, that is, disinfecting, reducing inflammation, cleansing, &c.

Cooling.

(103)	Rectified or methylated spirit	...	...	...	1 ounce.
	Water	...	...	...	1 pint.
(104)	Chloride of ammonia	...	...	}	4 ounces each
	Nitrate of potash	...	...
	Water	...	...	...	2½ to 3 pints.
(105)	Acetate of lead	...	...	...	4 drachms.
	Sulphate of zinc	...	...	...	4 drachms.
	Water	...	...	...	1 quart.
(106)	Acetate of lead	...	...	...	1 drachm.
	Water	...	...	...	1 pint.

Pain.

(107)	Powdered opium	...	...	...	½ drachm may be added to one pint of any of the above.
(108)	Extract of belladonna	...	...	...	1 drachm.
	Water	...	...	...	1 pint.

Astringent for reducing discharges.

(109)	Alum	...	...	...	5 to 10 grains.
	Water	...	...	...	1 ounce.
(110)	Sulphate of zinc	...	...	...	2 to 4 drachms.
	Water	...	...	...	1 pint.
(111)	Nitrate of silver	...	...	...	1 grain.
	Water	...	...	...	1 ounce.
(112)	Nitric acid (dilute)	...	...	}	2½ drachms. } For foul ulcers. 8 ounces. }
	Water	...	...
(113)	Sulphate of iron	...	...	...	2 to 4 grains.
	Water	...	...	...	1 ounce.

Disinfecting.

(114)	Carbolic acid	...	...	...	8 to 12 grains.
	Water	...	...	...	1 ounce (1-40) to (1-60).
(115)	Phenyle	...	...	...	2 to 4 drachms.
	Water	...	...	...	1 ounce (1-40) to (1-60).
(116)	Perchloride of mercury (corrosive sublimate)	...	...	...	5 to 10 grains.
	Water	...	...	...	1 pint (1-2000) to (1-1000).
(117)	Boracic acid	...	...	...	15 to 30 grains.
	Water (boiling)	...	...	...	1 ounce.
(118)	Borax	...	...	...	4 to 6 drachms.
	Water	...	...	...	1 pint.
(119)	Permanganate of potash*	...	...	...	2 to 4 grains.
	Water	...	...	...	1 pint.

* Candy's fluid contains 4 grains to the ounce.

(120) Thymol	...	...	...	... 10 grains.
Water (boiling)	...	...	...	... 1 pint.

Oils are lubricating agents and soothing applications used in various ways.

(121) Carbolic acid	...	...	...	... 1 part.
Sweet oil	...	...	...	... 16 to 20 parts.
[Used for lubricating the hands and instruments, and dressing wounds.]				
(122) Camphor	...	...	...	... 1 ounce.
Methylated spirit or other spirit	...	...	...	... Sufficient to dissolve the camphor.
Oil of turpentine	...	...	...	... 2 ounces.
Sweet oil	...	...	...	... 4 ounces.

Add the spirit to the camphor and rub down in a mortar till quite dissolved, then add the other ingredients.

A dressing to sores especially useful in keeping away flies.*

(123) Neem or margosa oil, also used to keep away flies and for removal of maggots. Crushed leaves of custard-apple tree also useful for this purpose.

Carron oil.

(124) Lime water	} Equal parts.
Olive oil	

To be well shaken. A very soothing application to burns and scalds.

Ointments are greasy preparations of soft consistency containing a variety of drugs for a variety of purposes.

				Parts.
(125) Carbolic acid	...	...	...	1
Vaseline †	...	...	...	20 to 25
(126) Boracic acid	...	...	...	1
Vaseline †	...	...	...	3
(127) Oxide of zinc	...	...	...	1
Vaseline †	...	...	...	8
(128) Iodoform	...	...	...	1 drachm.
Oil of eucalyptus	...	...	...	1 ounce.

Heat gently till dissolved and add paraffine and vaseline, of each $2\frac{1}{2}$ ounces. Melt together and stir till cold. Can be obtained at any chemists and is very useful to keep flies away.

				Parts.
(129) Iodoform	...	...	...	9 Drachms.
Vaseline †	...	...	...
(130) Dikamali ‡	...	...	...	15
Beeswax	...	...	...	6
Powdered gallnuts	...	...	...	18
Gingili oil	...	...	...

Boil the gallnuts in the oil, then add the *dikamali*, and when it is melted strain through a cloth, lastly add the wax and stir till cold—*Hawkes*.

Excellent anti-fly dressing.

* Spirits of camphor or plain powdered camphor are most useful for the removal of maggots in wounds.

† Lard may be substituted.

‡ The resin of the *Geranium lucida* and known as *dikamali* in Madras and Rangoon bazaars.

(131)	Resin	...	...	...	...	8 ounces.
	Beeswax	...	...	...	...	6 ounces.
	Olive oil	...	...	...	...	3 ounces.
	Lard	...	...	...	...	3 ounces.

Melt with gentle heat, strain the mixture while hot through a cloth, and stir constantly while cooling.

(132)	Creasote	...	...	...	...	1 part.
	Vaseline or lard	...	...	...	...	8 parts.
(133)	Common tar	...	...	...	...	} Equal parts.
	Resin	...	...	...	...
	Lard	...	...	...	...

Melt together by gentle heat and stir till cold: a dressing for the feet.

(134)	Sulphate of copper	...	...	...	...	1 part.
	Alum	...	...	...	...	1 part.
	Tar	...	...	...	...	4 parts.

Mix, stir, and heat together until the mass assumes a reddish brown colour.

A dressing especially useful for cracks and fissures about the feet.

(135)	Iodine	...	...	...	...	$\frac{1}{2}$ ounce.
	Iodide of potash	...	...	...	...	1 ounce.
	Vaseline or lard	...	...	...	...	8 ounces.

A good application for the dispersion of tumours, enlarged glands, &c.

Paints are fluid applications usually used to promote absorption of swellings or protection of raw surfaces.

136. **Protective paint.**—Sheet gelatine is soaked in sufficient 1 per cent. solution of corrosive sublimate to cover it. When it becomes quite soft melt by gentle heat and add glycerine equal to $\frac{1}{10}$ th the weight of the dry gelatine added. This gives it an elastic character. To use it, it is melted on a slow fire and painted over a wound, and it adheres equally well to moist or dry surfaces. The surface can be strengthened by laying on it while moist shreds of tow or strips of gauze.—*Moller.*

(137)	Carbolic acid	...	...	...	...	1 ounce.
	Camphor	...	...	...	...	5 ounces.
	Resin or shellac	...	...	...	...	1 ounce.
	Spirits of wine	...	...	...	...	15 ounces.

Hayes.

Dissolve the camphor and resin in the spirit, then add the carbolic acid and shake well. A protective dressing for wounds and useful to keep away flies.

Repeat as occasion requires.

138. **Liniment of Iodine.**—Applied once every other day painted on the swelling wished to be removed.

Poultices.—These are external applications of a soft consistence and act chiefly by virtue of their warmth or moisture. They are soothing, relieve pain and hasten the formation of matter, and are generally made of linseed meal or flour, or bran, and are rendered anodyne by adding a little laudanum, poppy-heads, &c., deodorizing by adding finely powdered charcoal, and antiseptic with eucalyptus oil, carbolic acid, solution of thymol, creasote, phenyle, &c.

Natives employ poultices of leaves of the *dhatūra* and *mudar* plants and *neem* tree to irritable painful sores, and also as a stopping for abscesses in elephants.

Hawkes states that the following native application has been found efficacious in expediting the filling up of abscesses with healthy flesh—

Dhatūra leaves	...	...	...	...	40 tolas.
Neem leaves	...	...	...	...	40 tolas.
Turmeric	...	...	...	...	5 tolas.
Salt	...	...	...	...	10 tolas.

Grind all together with a little water and introduce a portion of it into the opened abscess; remove it every second day, wash the cavity out and apply any lotion that may be necessary, and re-stop with the mixture. Owing to the size usually required and the difficulty of retaining poultices in position, fomentations are generally used in preference; they may, however, be used with advantage to many injuries about the limbs.

Poulticing boots.—These are most useful to keep an injured foot clean: the sole may be made of stout leather or wood, the uppers of ordinary leather, *they should be kept* soft with soap or grease.

Mussauls.—The following are some formulæ for *mussauls* usually employed:—

Astringents and anodyne in diarrhoea, colic, &c.

(a) Cardamoms	...	...	...	...	2 tolas.
Cinnamon	...	...	...	...	2 tolas.
Opium	...	...	...	...	1 tola.
Catechu	...	...	...	...	2 tolas.
Chalk	...	...	...	...	4 tolas.
Jaggery	...	...	...	...	10 tolas.
Brandy	...	...	...	...	$\frac{1}{2}$ pint.

Repeat every four hours till desired effect is produced.

(b) Opium	...	...	...	...	3 tolas.
Ginger	...	...	...	...	4 tolas.
Catechu	...	...	...	...	2 tolas.
Brandy	...	...	...	...	$\frac{1}{2}$ pint.

Repeat if necessary according to circumstances.

(c) Opium	} of each 5 drachms.
Assafœtida	...	...	...	...
Ginger	...	...	...	...
Nutmeg	...	...	...	...
Jaggery	...	...	...	...
Brandy	2 ounces.
					$\frac{1}{4}$ pint.

Repeat dose if necessary in two hours.

For Catarrh.

(d) Bedellium (or myrrh)	...	...	...	...	3 tolas.
Mustard seed	...	...	...	...	3 tolas.
Turmeric	...	...	...	...	3 tolas.
Assafœtida	...	...	...	...	4 tolas.
Borax	...	...	...	...	3 tolas.

Add sufficient wheat flour to make three pills: one night and morning.

Fever.

(e) Aconite leaves (powdered)	...	...	...	...	1 tola.
Calomel	...	...	...	...	2 tolas.
Jaggery	...	...	...	...	20 tolas.

Divide into eight pills: one to be given every night.

(f) (1) Nitre	...	...	...	...	2 tolas.
(2) Camphor	...	...	...	...	1 tola.
(3) Darchob (<i>Berberis Asiatica</i>)	...	...	...	...	3 tolas.
(4) Jaggery	...	...	...	...	6 tolas.
(5) Vinegar	...	...	...	...	$\frac{1}{4}$ pint.

Rub Nos. (2) and (4) together, make (3) into a fine powder, add (1) and (5), and mix the whole well; place in a piece of plantain leaf and give. Dose to be repeated three times a day.

This is also a strong diuretic—

(g) Sour milk	...	...	...	...	4 pounds.
Onions	...	...	...	...	$1\frac{1}{2}$ pounds.
Green ginger	...	...	...	...	$\frac{1}{2}$ pound.
Saltpetre	...	...	...	...	2 tolas.
Jaggery	...	...	...	...	1 pound.
Ghee	...	...	...	...	1 quart— <i>Hawkes</i> .

A cooling mussaul. Give every morning for three successive days.

(h) Tartar emetic	...	...	...	...	2 drachms.
Aconite leaves	...	...	...	...	2 drachms.
Wheat flour	...	...	...	...	} A sufficiency— <i>Steel</i> .
Ghee	...	...	...	...

Mix and make into a pill. This mussaul is given as a sedative in fever, &c.

APPENDIX B.
List of diseases with their names in *Hindustani and Burmese.*

No.	English.	Hindustani.	Burmese.
CHAPTER IV.			
1	Fever	Thap or tup, bokhar	အဖျားရောဂါ။
2	Debility	Doobla or laghar, kumzor	ခွန်အား ဝျော့နွား၊ ရွဲနဲ့ရောဂါ။ ဝါ။
	(a) Emaciation	Sookha zahirbad	မိန်ချိုရောဂါ။
	(b) Dropsy	Zahrbad or zahirbad	ရေဖျင်းရောဂါ။
	(c) Œdematous swelling of the limbs...	Soojun	ခြေရောင်ပေါရောဂါ။
CHAPTER V.			
3	Anthrax fever (apoplexy of the lungs)	Goli	ခေါင်သန်းအဖျားရောဂါ။ ဂျိတ်နားထောက်နား။ အဖျားရှင်။
4	Elephant-pox	Ghut-bhao	အဆုတ်နှင်းဆိုင်ထောက်နား။
5	Surra	Seethlah matha	ကျောက်ရောဂါ။
6	Foot-and-mouth disease	Surra	သွတ်။
	(Ulceration of the mucous membrane of the trunk with ulceration of the feet.)	Mupoung	ဝါးစင်နှင်းခြေခြာဖြစ်သောရောဂါ။ ဟွာနာခွါနား။
7	Blood poisoning	Kuthlah (a term applied to disease of the feet).	(နှာမောင်းအတွင်း အဖျား အတာနှင့် ခြေဖျားမှ အနာပိမ်းကထေးများပေါက်ခြင်း။)
8	Rabies	Pagal or dewanah, kootha ka murz	သွေးအဆိပ်အထောက်ဖြစ်ရောဂါ။ သွေးရူးထိုက်နား။

List of diseases with their names in Hindustani and Burmese—continued.

No.	English.	Hindustani.	Burmese.
24	Pneumonia (a) Acute inflammation of lungs (b) Chronic Bronchitis ... ..	..... Phipsa-ka-murz Dhumay Khasi	အဆုတ်ရောဂါ။ အဆုတ်ပူထောင်ခြင်းရောဂါ။ ထာရှုညှိစွာအဆုတ်ပူထောင်၍ဖွဲ့ခြင်း။ ချောင်းဆိုးရောဂါ။
CHAPTER IX.			
26	Inflammation of kidneys	Stinga-bundh-ka-murz	ကျောက်ကပ်ပူထောင်ခြင်း။
27	Inflammation of bladder ... ..	.....	ဖြင့်ငယ်ဆိပ်ပူထောင်ခြင်း။
28	Retention of urine	Istinga-bundh	ဆီးချုပ်ရောဂါ။
29	Hæmaturia (bloody urine)	Koosum-ka-murz	ဆီးပွဲထွေးကျခြင်းရောဂါ။
30	Diabetes ... ..	.....	ဆီးအထွန်ထွားခြင်း (ကျင်ပြောင်ယောရောဂါ)။
CHAPTER X.			
31	Diarrhœa	Sangranee joolab	ပျိုးပိုးဝမ်းကျ။
32	Superpurgation ... ..	.....	ဝမ်းနှုတ်ထေးထွန်၍ဝမ်းအများကျခြင်း။ (ဝမ်းထွန်ခြင်း။)
33	Constipation	Pate-bundh	ဝမ်းချုပ်ရောဂါ။
34	Colic (spasmodic) (gripes)	Pate-ka-durdh	ဝမ်းကိုက်ရောဂါ။
	Colic (flatulent)	Wakee-golah, bahdh-golah	ဝမ်းပွင့်ရစ်၍နာခြင်း။ ထေဝမ်းထိုက်ရောဂါ။

35	Indigestion ... ..	...	.....	...	အစာမကြေရောဂါ။
36	Stomatitis (inflammation of the cheek)	...	Sozish-gallki	...	ဝါးရောင်ခြင်းရောဂါ။
37	Disorders and irregularities of the teeth	...	Koochla	...	{ သွားမညီညွတ်၍ ကွဲခြင်း။ သွားရိုးထခြင်း။
38	Inflammation of the bowels	...	Bhao	...	ဆူရောင်ရန်ခြင်းရောဂါ။
39	Dysentery ... ..	...	Paichis or ecray-sangraee	...	ထွေးသွန် ဝမ်းကျရောဂါ။
40	Dysentery (epidemic)	...	.....	...	ကျွဲတက်သောသွေးပါဝမ်းကျနာ။
41	Intestinal obstruction	...	.....	...	ဆူပိတ်၍ရောဂါ။
42	Peritonitis ... ..	...	.....	...	ဝမ်းခေါင်းအဖွေးအထာပူထောင်ခြင်း။
43	Vomiting .. ..	...	Dhaak-ka-murz	...	ဆော့ဆံခြင်းရောဂါ။
44	Poisoning ... ..	...	Ze-hir	...	အဆိပ်အတောက်ဖြစ်ခြင်း။
45	Internal parasites (worms)	...	Luungun	...	ထံထိုးရောဂါ။
	CHAPTER XI.				
46	Jaundice ... ..	...	.....	...	သည်းဖြေရောဂါ။
47	Inflammation of liver	...	Lokum-durdh	...	အသည်းပူထောင်ခြင်းရောဂါ။
48	Hydatids ... ..	...	.....	...	ဆူအသည်းတိုင်းအညှိတက်သောဝါးထမျှ။
	CHAPTER XIII.				
49	Ophthalmia (sore eyes)	...	Agin-bhao	...	မျက်စိနာရောဂါ။

List of diseases with their names in Hindustani and Burmese—continued.

No.	English.	Hindustani.	Burmese.
50	Inflammation of the cornea	.....	သထာထွမ်းခြင်းရောဂါ။
51	Ulceration of the cornea	.....	မျက်စေ့၌မျက်ထွာပူထောင်ခြင်း။
52	Opacity of the cornea	Dhul-ka-murz	မုင်းအနာထထေးများပေါက်ခြင်း။
53	Staphyloma	Mothea-beenj	အတွင်းတိမ်ရောဂါ။တိမ်ထာရောဂါ။
54	Cataract (blindness)	Undha	ကြက်ဆူးထွက်ရောဂါ။ မျက်စေ့ကန်းခြင်း။ကြောင်ထောင်ကန်း။
CHAPTER XIV.			
55	Musth	Musth	မုန်း
56	Inflammation of the temporal (kuppoo) glands.	Amasyace	မုန်းမြိုခြင်း။
CHAPTER XV.			
57	Inflammation of the skin	.....	သားရေပူထောင်ခြင်းရောဂါ။
58	Abrasions (bruises, &c.)	Shoo-chal-jana	အထားကျေနာ။
59	Wounds	Zukkum or gao	ဒဏ်ရာဒဏ်ချက်၊အထွဲအရှု။
60	Ulcers (sores)	Pohdaygoi	အနာ၊အနာပိင်း။

61	(a) Above the feet ...	...	(ဖြေပေါ်၌။)
62	(b) On the elbows ...	.....	(ထံထောင်ထပ်ပေါ်၌။)
	(c) On the forehead ...	.....	(ဥကင်းထိပ်ပေါ်၌။)
	(d) Of the cartilage of the ear ...	Indhree-ka-murz ...	နား ရွက်ရိခြင်း။
	(e) Fœtid discharge from orifice of ear ...	Kan-sai-peeep-nickalna.	နားပြည်ပုပ်ရိခြင်း။
	(f) Ulcers of the tail (affections of the tail).	Burnee or bomanee	အပြီးရုံနာ။
	Cracked heels ...	Sajhan.	ခြေပခောင်းကွနာ။
	Abscess ...	Bale-ka-murz ...	သွေးပုတ်နားအိုင်နာ။
	(a) Of foot ...	.....	မြေအနာပျက်ရောဂါ။
	(b) Serous ...	.....	အနာမှထွေးထြက်ထက်ရည်ရှိကျခြင်း။
63	Boils ...	Russolee-nunj (blind boils) ...	ထွေးရနာ။
64	Warty growths around nails ...	Ghutta-hnowka ...	ထက်စွယ်မြေပွယ်ပုပ်ခြင်း။
65	In-growing and overgrown nails ...	.....	မြေပည့်လက်ထည့်ရှည်ထွက်ခြင်း။
66	Moisture around and under the nails ...	Pagor-ke-bimarri	မြေထည့်ရိပုပ်ခြင်း။
67	Eczema ...	Agin-bhao (also ophthalmia) ...	သားရေရောဂါ။
68	Urticaria ...	.....	သားရေအပေါ်၌အပူထွက်ခြင်း။
69	Pityriasis (scurf) ...	Khareesh ...	သားရေတွာခြင်း။
70	External parasites ...	.....	ပိုးမွှားတူထိခြင်း။
71	Tender feet (bursting, cracking and tenderness of the soles of the feet).	Thullee ...	ထင်ထိနာပုံကွာ၍အထားနုထက်ခြင်း။
72	Inflammation of the feet ...	.....	မြေရောင်ရနိုးခြင်း။

List of diseases with their names in Hindustani and Burmese—concluded.

No.	English.	Hindustani.	Burmese.
	CHAPTER XVI.		
73	Sprains	Lutchuk, kutchwa ...	...
74	Fractures	Haddee-ka-tut-jana ...	အကြောချက်ခြင်း။
75	Chowrung	Gunruss or chowrung.	အပိုးထိုးခြင်း။
76	Cramp ... ..	.....	ကြက်တက်ခြင်းစောင်း။
77	Mukoondah	Mukoondah.	...

Number of miles traversable on undulating ground with light, medium and heavy loads—continued.

Configuration of ground.	Nature of the surface.	Time of the day.	Shade or otherwise.	Number of days' rest before and after.	Degree of regularity.	MILES TRAVERSABLE.						Remarks.								
						No load.		Light load.		Medium load.			Heavy load.							
						Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.							
Even and firm.		Heat of day.	(Little or none in cool weather.)	0	Once Twice Repeatedly ...	23	21	19	16	19	16	16	14	One-half of morning and evening march may be added.						
						21	20	18	16	15	14	13	12	11	10	9	8	7	6	5
						19	18	16	15	14	13	12	11	10	9	8	7	6	5	
						18	16	15	14	13	12	11	10	9	8	7	6	5		
						17	16	15	14	13	12	11	10	9	8	7	6	5		
						15	14	13	12	11	10	9	8	7	6	5	4	3		
		Heat of day.	(Always)	2	Once Twice Repeatedly ...	0	Once Twice Repeatedly ...	20	19	18	16	16	14	14	13	One-half of morning and evening march may be added.				
								19	18	16	15	14	13	12	11	10	9	8	7	
								17	16	15	14	13	12	11	10	9	8	7	6	5
								15	14	13	12	11	10	9	8	7	6	5	4	3
								14	13	12	11	10	9	8	7	6	5	4	3	2
								13	12	11	10	9	8	7	6	5	4	3	2	1

Undulating.		Freshly cleared or stony road.		Night, morning and evening.		Morning and evening.		
(Little or none in hot weather.) (Of course) (Of course)	2	{ Once Twice Repeatedly ... }	{ 20 19 18 17 }	{ 19 18 17 }	{ 17 16 15 14 13 }	{ 16 15 14 }	{ 15 14 13 }	
	1	{ Once Twice Repeatedly ... }	{ 17 16 15 14 13 }	{ 16 15 14 13 }	{ 15 14 13 }	{ 14 13 12 }	{ 13 12 11 }	
	0	{ Once Twice Repeatedly ... }	{ 14 13 12 11 }	{ 13 12 11 }	{ 12 11 10 }	{ 11 10 9 }	{ 10 9 8 }	{ 9 8 7 }
	2	{ Once Twice Repeatedly ... }	{ 25 24 23 22 21 }	{ 23 22 21 }	{ 22 21 20 }	{ 21 20 19 18 }	{ 20 19 18 }	{ 19 18 17 }
	1	{ Once Twice Repeatedly ... }	{ 21 20 19 18 }	{ 20 19 18 }	{ 19 18 17 }	{ 18 17 16 }	{ 17 16 15 }	
	0	{ Once Twice Repeatedly ... }	{ 17 16 15 14 }	{ 16 15 14 }	{ 15 14 13 }	{ 14 13 12 }	{ 13 12 11 }	
	2	{ Once Twice Repeatedly ... }	{ 18 17 16 15 14 }	{ 17 16 15 14 }	{ 16 15 14 }	{ 15 14 13 }	{ 14 13 12 }	
	1	{ Once Twice Repeatedly ... }	{ 15 14 13 }	{ 14 13 12 }	{ 13 12 11 }	{ 12 11 10 }	{ 11 10 9 }	
	0	{ Once Twice Repeatedly ... }	{ 12 11 10 }	{ 11 10 9 }	{ 10 9 8 }	{ 9 8 7 }	{ 8 7 6 }	
	0	{ Once Twice Repeatedly ... }	{ 12 11 10 }	{ 11 10 9 }	{ 10 9 8 }	{ 9 8 7 }	{ 8 7 6 }	

No other march may be made.

Number of miles traversable on undulating ground with light, medium and heavy loads—continued.

Configuration of ground.	Nature of the surface.	Time of the day.	Shade or otherwise.	Number of days, rest before and after.	Degree of regularity.	MILES TRAVERSABLE.						Remarks.																					
						No load.		Light load.		Medium load.			Heavy load.																				
						Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.		Good rations and fodder.	Indifferent.																			
}	}	Heat of day.	(Little or none in cool weather.)	2	Once Repeatedly ...	16	15	13	12	11	10	9	8	13	12	11	10	9	8	10	9	8	7	6	5	4	3	2	One-half of morning and evening march may be added.				
						15	14	13	12	11	10	9	8	12	11	10	9	8	7	6	5	4	3	2	9	8	7	6		5	4	3	2
						14	13	12	11	10	9	8	7	11	10	9	8	7	6	5	4	3	2	8	7	6	5	4		3	2		
						13	12	11	10	9	8	7	6	10	9	8	7	6	5	4	3	2	7	6	5	4	3	2					
						12	11	10	9	8	7	6	5	9	8	7	6	5	4	3	2	6	5	4	3	2							
						11	10	9	8	7	6	5	4	8	7	6	5	4	3	2	5	4	3	2									
						10	9	8	7	6	5	4	3	7	6	5	4	3	2	4	3	2											
						9	8	7	6	5	4	3	2	6	5	4	3	2	3	2													
						8	7	6	5	4	3	2	1	5	4	3	2	2	1	1													
						7	6	5	4	3	2	1	0	4	3	2	1	1	0	0													
						6	5	4	3	2	1	0	0	3	2	1	0	0	0	0													
						}	}	Heat of day.	(Always)	1	Once Repeatedly ...	15	14	13	12	11	10	9	8	12	11	10	9	8	7	6	5	4		3	2	9	8
14	13	12	11	10	9							8	7	11	10	9	8	7	6	5	4	3	2	8	7	6	5	4	3	2			
13	12	11	10	9	8							7	6	10	9	8	7	6	5	4	3	2	7	6	5	4	3	2					
12	11	10	9	8	7							6	5	9	8	7	6	5	4	3	2	6	5	4	3	2							
11	10	9	8	7	6							5	4	8	7	6	5	4	3	2	5	4	3	2									
10	9	8	7	6	5							4	3	7	6	5	4	3	2	4	3	2											
9	8	7	6	5	4							3	2	6	5	4	3	2	3	2													
8	7	6	5	4	3							2	1	5	4	3	2	2	1	1													
7	6	5	4	3	2							1	0	4	3	2	1	1	0	0													
6	5	4	3	2	1							0	0	3	2	1	0	0	0	0													
5	4	3	2	1	0							0	0	2	1	0	0	0	0														
4	3	2	1	0	0							0	0	1	0	0	0	0															
}	}	Heat of day.	(Little or none in hot weather.)	2	Once Repeatedly ...	13	12	11	10	9	8	7	6	10	9	8	7	6	5	4	3	2	7	6	5	4	3	2	other march be made.				
						12	11	10	9	8	7	6	5	9	8	7	6	5	4	3	2	6	5	4	3	2							
						11	10	9	8	7	6	5	4	8	7	6	5	4	3	2	5	4	3	2									
						10	9	8	7	6	5	4	3	7	6	5	4	3	2	4	3	2											
						9	8	7	6	5	4	3	2	6	5	4	3	2	3	2													
						8	7	6	5	4	3	2	1	5	4	3	2	2	1	1													
						7	6	5	4	3	2	1	0	4	3	2	1	1	0	0													
						6	5	4	3	2	1	0	0	3	2	1	0	0	0	0													
						5	4	3	2	1	0	0	0	2	1	0	0	0	0														
						4	3	2	1	0	0	0	0	1	0	0	0	0															
						3	2	1	0	0	0	0	0	0	0	0	0	0															
						2	1	0	0	0	0	0	0	0	0	0	0	0															

Undulating.		Freshly cleared or stony		Night, morn- ing and evening.		Morning and even- ing.		Heat of day.		One-half of morning and evening may be added.		No May
0	{ Once Twice Repeatedly ... }	8 7 6	7 6 5	5:5 5 4	4:5 4 3	3:5 3 2:5	3 2 1	3:5 2:5 2	3 2 1	3:5 2:5 2	3:5 2:5 2	1:5 1 1:5
2	{ Once Twice Repeatedly ... }	13 12 11 12	12 11 10 11	11 10 9 10	10 9 8 9	8 7 6 7	8 7 6 7	8:5 8 7 8	8 7 6 7	8 7 6 7	8 7 6 7	6:5 6 5:5 6
1	{ Once Twice Repeatedly ... }	11 11 10	10 9 8	9 8 7	8 7 6 7	7 6 5 6	7 6 5 6	7 6 5 6	7 6 5 6	7 6 5 6	7 6 5 6	5 4:5 4 5
0	{ Once Twice Repeatedly ... }	9 9 8	8 7 6	6 5 4	5:5 4:5 4	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	3 2:5 2:5
2	{ Once Twice Repeatedly ... }	12 11 11	11 10 9	10 9 8	9 8 7	8 7 6 7	8 7 6 7	8:5 8 7 8	8 7 6 7	8 7 6 7	8 7 6 7	5 4:5 4 5
1	{ Once Twice Repeatedly ... }	10 10 9	9 8 7	7 6 5	6 5 4	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2:5
0	{ Once Twice Repeatedly ... }	8 8 7	7 6 5	4 3 2	3:5 3 2	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	2 1:5 1:5
2	{ Once Twice Repeatedly ... }	10 9 9	9 8 7	8 7 6	7 6 5	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	4 3 2	3 2 1:5
1	{ Once Twice Repeatedly ... }	8 8 7	7 6 5	6 5 4	5 4 3	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	1 1:5 0
0	{ Once Twice Repeatedly ... }	7 6 6	6 5 4	4 3 2	3:5 3 2	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	2 1 0	1:5 0 0

APPENDIX E.

Number of miles traversable on mountainous ground with light, medium and heavy loads.

Configuration of ground.	Nature of the surface.	Time of the day.	Shade or otherwise.	Number of days' rest before and after.	Degree of regularity.	MILES TRAVERSABLE.						Remarks.																
						No load.		Light load.		Medium load.			Heavy load.															
						Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.	Good rations and fodder.	Indifferent.		Good rations and fodder.	Indifferent.														
Mountainous.	Firm and even.	Night, morning and evening.	(Of course)	2	Once Twice Repeatedly ...	25	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7					
						24	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3		
						22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
						21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1
						20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2
						19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3
		Morning and evening.	(Of course)	1	Once Twice Repeatedly ...	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2			
						16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4		
						15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5		
						14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6		
						13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7		
						12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8		

Mountainous.	Newly cleared or stony road.	Heat of day.	Morning and evening.	Night, morning and evening.	(Of course)	(Little or none in hot weather.)	0	1	2	Once	Twice	Repeatedly	...	13	12	11	10	9	8	7	6	5	4	3	2	1	0	One-half of morning and evening march may be added.
Mountainous.	Newly cleared or stony road.	Heat of day.	Morning and evening.	Night, morning and evening.	(Of course)	(Little or none in hot weather.)	0	1	2	Once	Twice	Repeatedly	...	13	12	11	10	9	8	7	6	5	4	3	2	1	0	One-half of morning and evening march may be added.
										Twice	Twice	Twice	...	12	11	10	9	8	7	6	5	4	3	2	1	0	No other march may be made.	
										Repeatedly	Repeatedly	Repeatedly	...	11	10	9	8	7	6	5	4	3	2	1	0	No other march may be made.		
										...	...	...	...	10	9	8	7	6	5	4	3	2	1	0	No other march may be made.			
										...	...	...	...	9	8	7	6	5	4	3	2	1	0	No other march may be made.				
										...	...	...	...	8	7	6	5	4	3	2	1	0	No other march may be made.					
										...	...	...	...	7	6	5	4	3	2	1	0	No other march may be made.						
										...	...	...	...	6	5	4	3	2	1	0	No other march may be made.							
										...	...	...	...	5	4	3	2	1	0	No other march may be made.								
										...	...	...	...	4	3	2	1	0	No other march may be made.									
										...	...	...	...	3	2	1	0	No other march may be made.										
										...	...	...	...	2	1	0	No other march may be made.											
										...	...	...	...	1	0	No other march may be made.												
										0	No other march may be made.													
																							

A list of useful drugs to be kept in Sick Elephant lines. All drugs should be kept under lock and key.

	lbs.	oz.
Acid, acetic, dilute (vinegar)	1	...
Acid, arsenious (white arsenic) ... ..	...	1
Acid, boracic	4	...
Acid, carbolic	2	...
Acid, nitric (strong) ... ..	...	$\frac{1}{2}$
Aloes, Barb.	2	...
Alum	2	...
Ammonia, liquor (strong)	1	...
Antimonium, tart. (tartar emetic) ... ..	...	4
Arsenicalis, liquor	1	...
Belladonna (extract) ... ..	...	2
Bicarbonate, soda	1	...
Camphor	1	...
Cantharides ... ..	...	4
Catechu (cutch)	4	...
Chiretta ... ..	...	4
Cinchona bark (powdered) ... ..	...	8
Corrosive sublimate ... ..	...	$\frac{1}{2}$
Creta præparata (prepared chalk)	4	...
Cupri, sulphas (blue-stone)	1	...
Dhatura leaves... ..	...	2
Dhatura seeds ... ..	...	1
Epsom salts	10	...
Ferri, sulphas (sulphate of iron)	2	...
Galls	$\frac{1}{2}$	...
Gentian	4	...
Glycerine ... ..	...	8
Hyoscyamus ... ..	...	1
Hydrargyri iodidum rubrum (red iodide of mercury) ..	...	2
Iodoform ... ..	...	4
Iodine, liniment of ... ..	...	4
Iodide of potash ... ..	...	2
Indian hemp { bhang ... ..	...	8
{ ganja ... ..	...	8
Nitrate of potash (nitre)	2	...
Nitrate of silver (lunar caustic) ... ..	...	1
Nux vomica (powdered) ... ..	...	2
Oil, croton ... ..	...	$\frac{1}{2}$
Oil, ricini (castor oil)	3	...
Oil, lini (linseed oil)	3	...
Oil, turpentine	4	...
Opium	1	...
Phenyle	2	...
Pix liquida (tar)	4	...
Plumbi acetas (sugar of lead) ... ..	...	8
Soap, soft	2	...
Soap, hard	1	...
Spirits, ætheris ... ..	...	8
Spirits, ætheris nitrosi (sweet spirits of nitre) ..	1	...
Sulphur, sublimed	1	...
Tincture of aconite ... ..	...	1
Tincture of iodine ... ..	...	4
Vaseline	2	...
Zinci, oxide ... ..	...	4
Zinci, sulphas ... ..	...	4

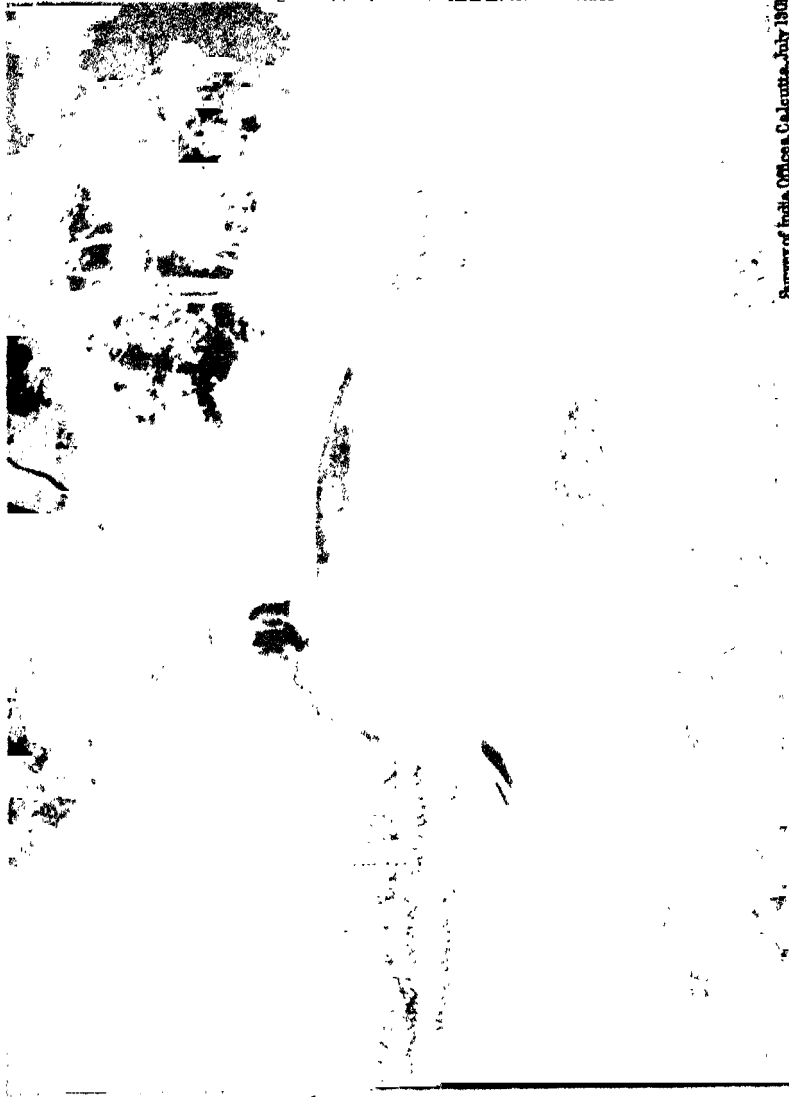
Drugs that can be procured in a pure state from the bazaar.

Ammonia, chloride.
 Allspice.
 Aniseed.
 Assafœtida.
 Carraway.
 Capsicum.
 Cardamoms.
 Chiretta.
 Cinnamon.
 Cloves.
 Cocoanut oil.
 Coriander.
 Cummin.
 Dicamali.
 Garlic.
 Ghee.

Ginger.
 Gum arabic.
 Jaggery.
 Linseed meal.
 Mustard.
 Mutton fat (or lard).
 Nutmegs.
 Oil of mustard.
 Pepper (black).
 Pepper (long).
 Salt, common.
 Soap, bar.
 Sesamum oil.
 Tamarind.
 Treacle.
 Turmeric.

Blankets for fomentation.

PLATE A.



Survey of India, Office, Calcutta, July 1931.

Photographer.

An ideal specimen of a timber working elephant. Indications of enormous power in head and trunk, short thick neck, in fact well put together in every particular, stands well up at the shoulder. Gradually sloping down behind, with the hind legs short indicating great dragging power, tusks and curve of back perfect—Height about 7-10'.

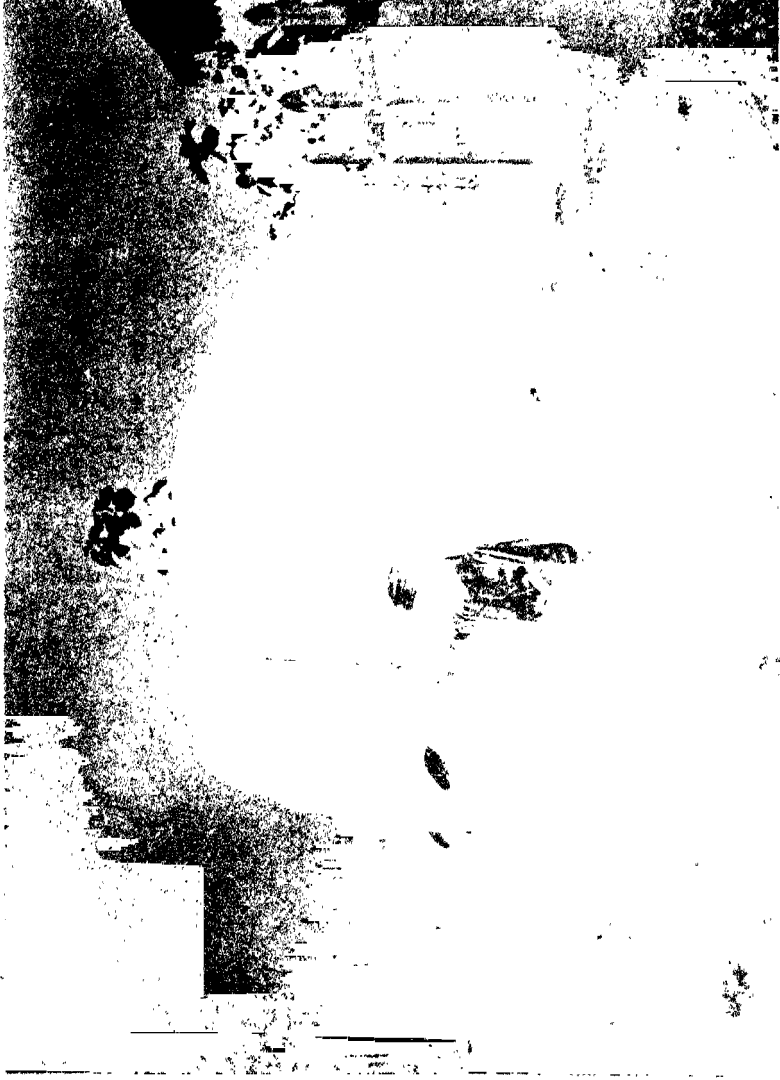
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PLATE B.



Photogeorama.

Survey of India, Office, Calcutta, July 1911

This elephant is probably one of the finest workers in the Province, he is now aged hence prominence of the spinal ridge, the tusks are also well worn, he however shows the strong points of the elephant in plate A.—Height about 8'.

PLATE U.



Survey of India, Office, Calcutta, July 1901.

Photogravure.

A fine specimen of a Te' (dragging elephant)

PLATE D.



Survey of India Office, Calcutta, July 1933

Fine specimen of a female elephant.

Photogravure.

KYA-PAZAT.

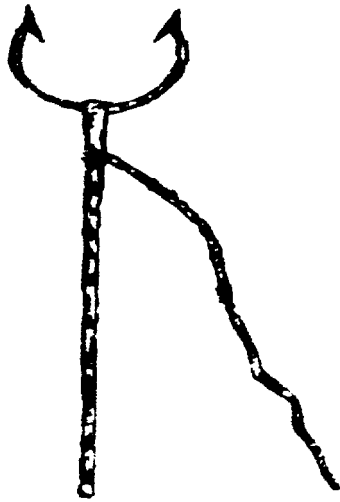


Fig. 1.

"KYA-PAZAT" OR "ANDOOS."—Forefoot fetter.

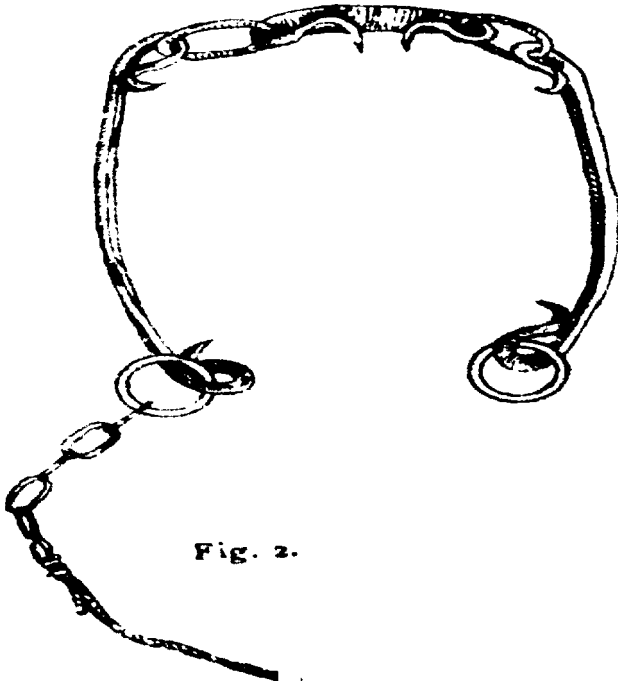


Fig. 2.

" KYA-PAZAT " " OR ANDOOS."

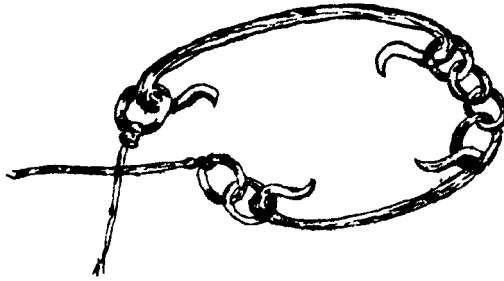


Fig. 3. Hind fetter for one foot only. It consists of two bent pieces of iron joined on one side by a short strong chain or rope and fastened off on the other by a line which is tied to a tree. The bent pieces of iron have four sharp points A turned inwards, which on the elephant attempting to move enter the leg.

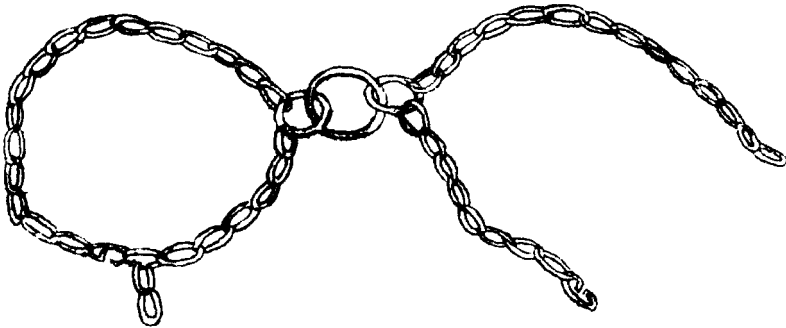
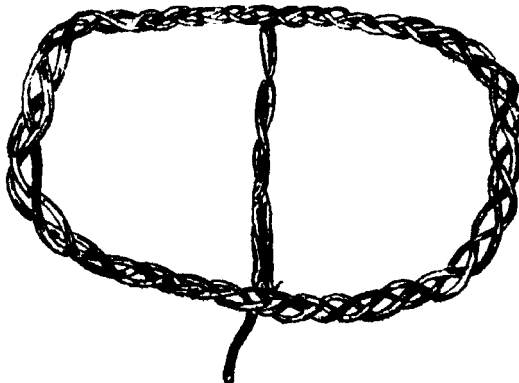


Fig. 4. Chain hobbles for forelegs.



**Fig. 5.
Fetter for forelegs made of cane or strong creepers**

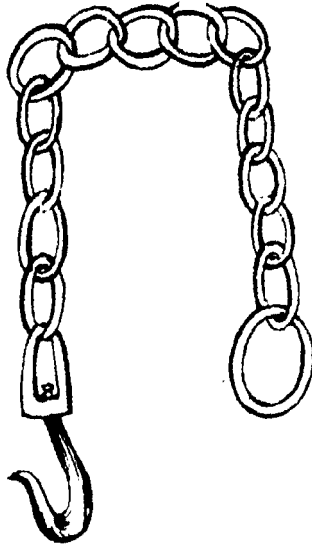


Fig. 9.

Fettering chain about 12 feet long,
used for one hind leg only.



Fig. 10.

Common spear with which every elephant coolie should be
provided, in case of his charge becoming unmanageable
by getting musth, &c.

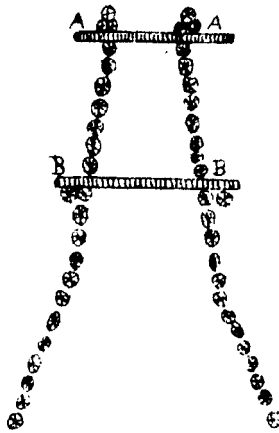


Fig. 11

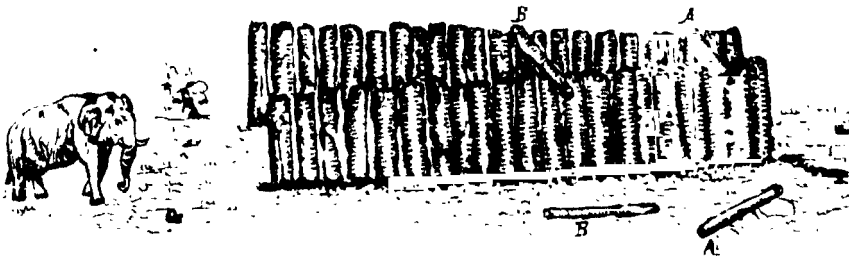


Fig 12.

Crush.

Employed for handling and breaking in unruly elephants, especially those not allowing men to mount them. Can also be used for operations.

Fig. 11 Poles in position at A and B.

Fig. 12. Poles in position above, withdrawn below A and B.

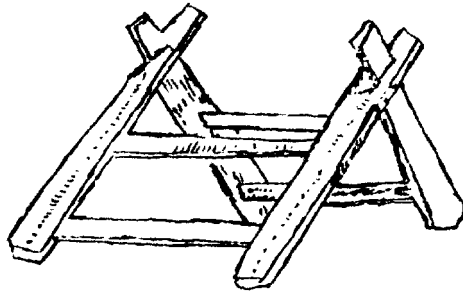


Fig. 13.

Elephant dragging saddle in present use

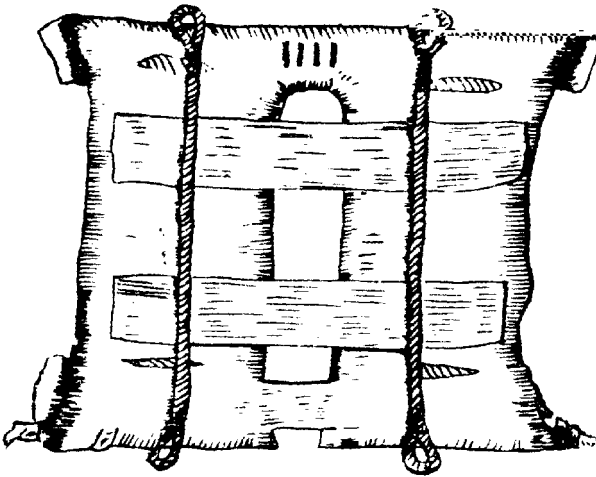
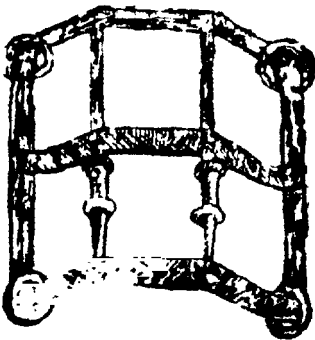
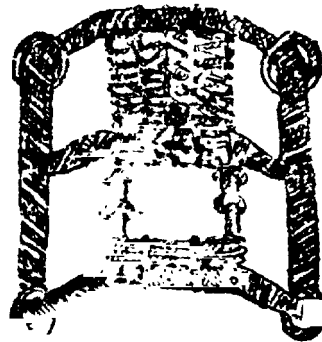


Fig. 14.

Sanderson's pattern Guddee



Plain.



Wrapped for use.

Fig. 15.



Sanderson's pattern Neck-rop.

Fig. 16.

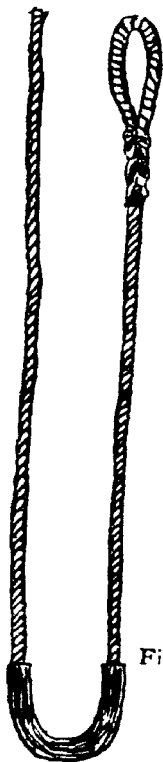


Fig 17

Sanderson's pattern Crupper-rop.

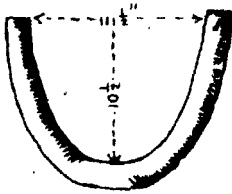


Fig 18.

Iron Pipe-Crupper (Sanderson)

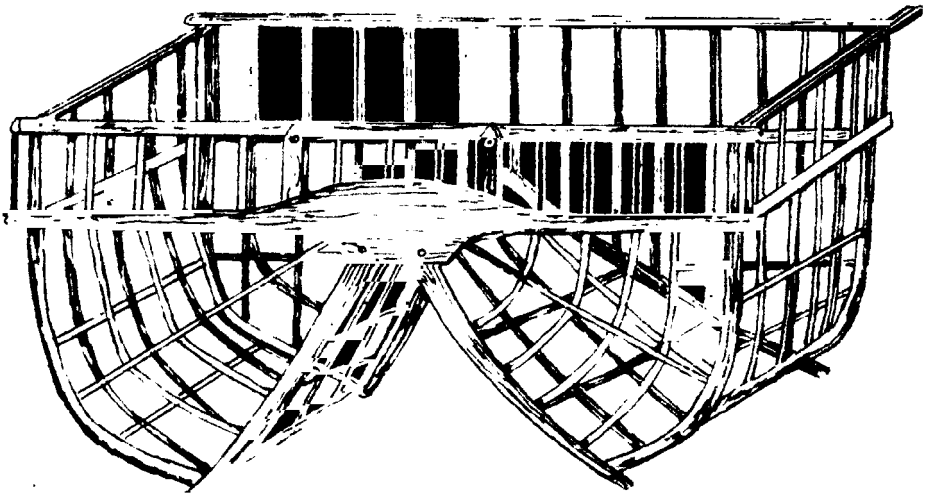


Fig 19

ONE FORM OF HOWDAH USED IN TRAVELLING BY THE
BURMESE AND SHANS.

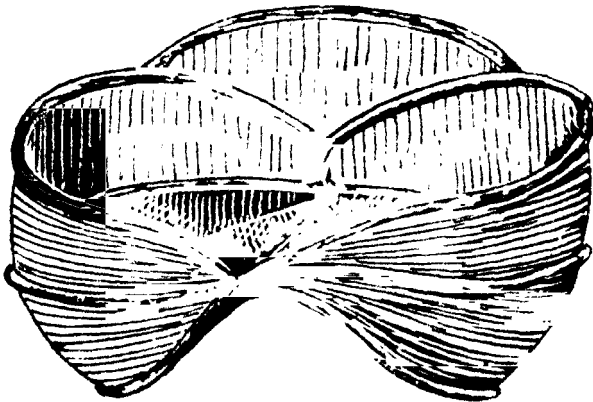


Fig 20.

KAREN HOWDAH FOR CARRYING GRAIN.

SKULL OF ELEPHANT.

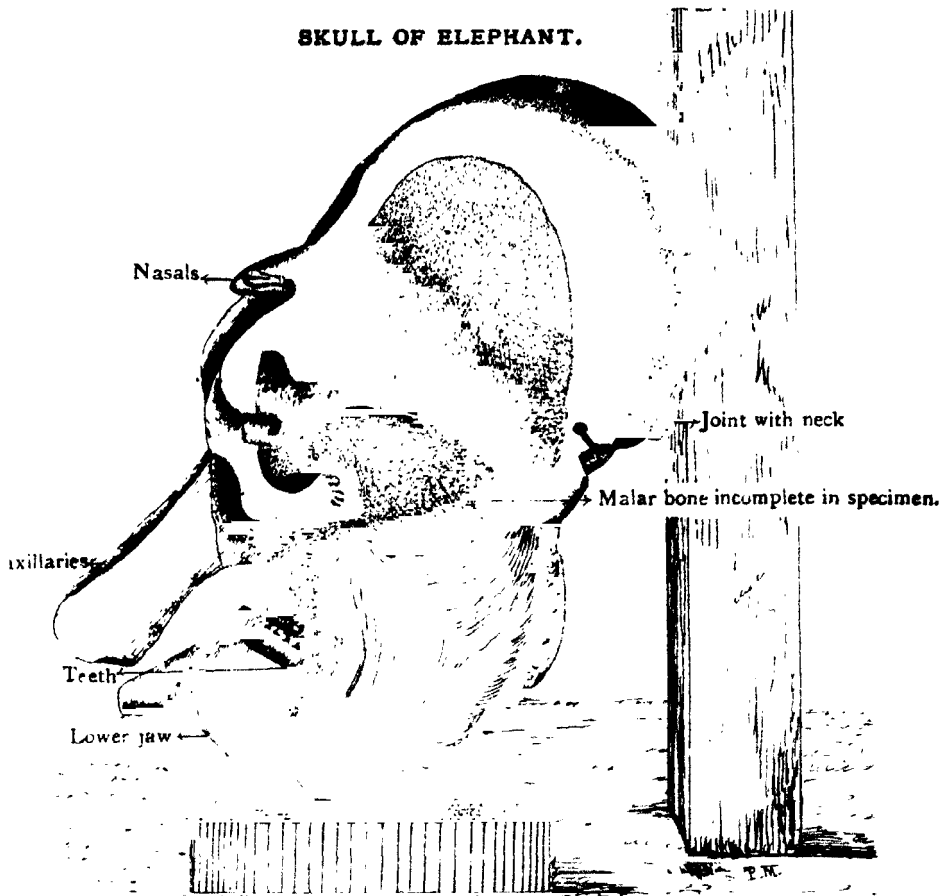
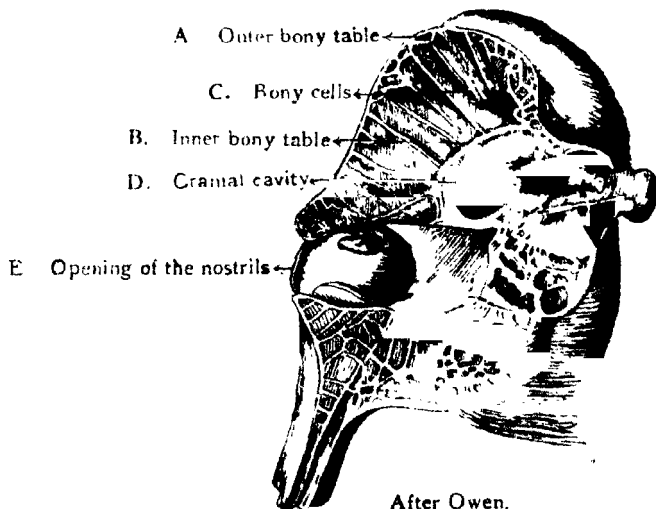


Fig. 22.

SECTION OF SKULL.



After Owen.

BRAIN OF THE ELEPHANT, SHOWING ORIGIN OF IMPORTANT NERVES.

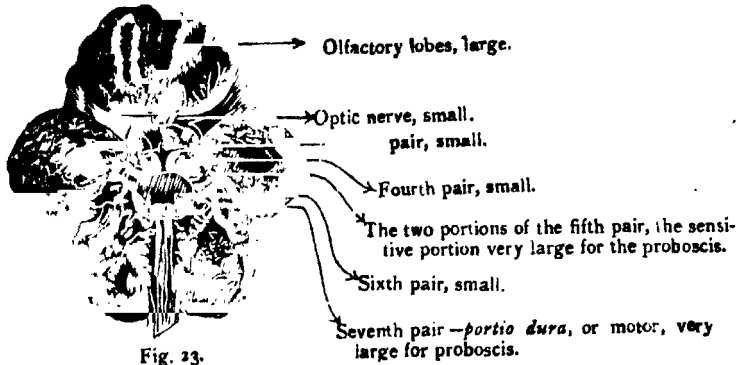
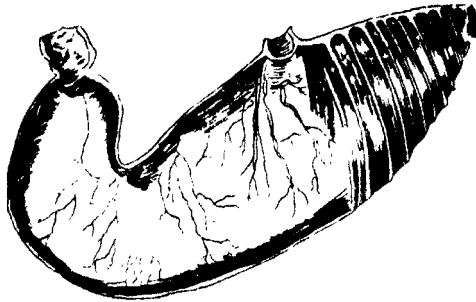


Fig. 23.

From J. Emerson Tennent.

THE CELLS SHOWN ARE MUCH EXAGGERATED, -SEE DESCRIPTION OF STOMACH.



Elephant's Stomach after Camper, from J. E. Tennent.

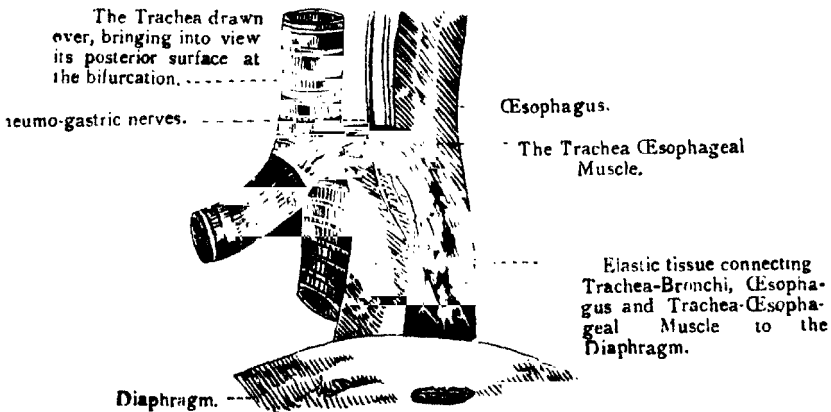


Fig. 25.

After Harrison, from J. E. Tennent.

**DIAGRAM FROM "SANDERSON" SHOWING POSITION OF THE
BRAIN WITH REFERENCE TO THE SHOOTING OF ELEPHANTS**

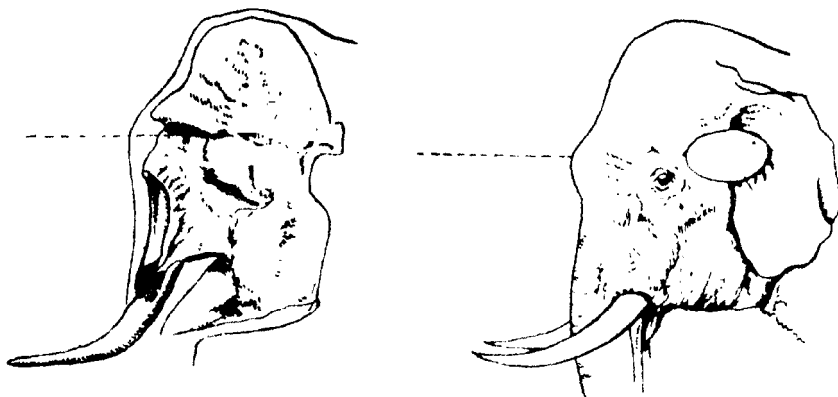


Fig. 2.

• **Head in natural position.**
Frontal shot indicated by dotted line.
Side shot indicated by blank space. Fig. 2.

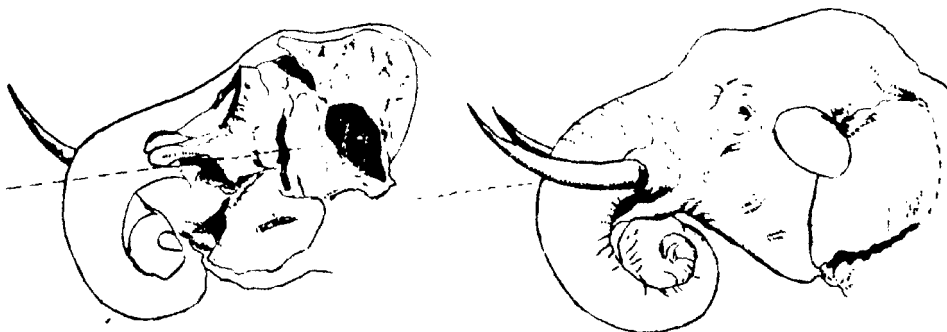


Fig. 3.

Fig. 4.

Position of head when charging.
Frontal shot indicated by dotted line.

PARASITES OF THE ELEPHANT.

Under view of elephant 'bot,' natural size.



Side view of same.



Fig. 27.

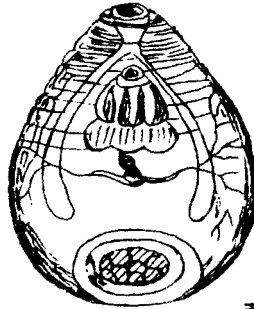
Ascaris lonchoptera.



Natural size.

Fig. 28.

Amphistoma Hawkesli.



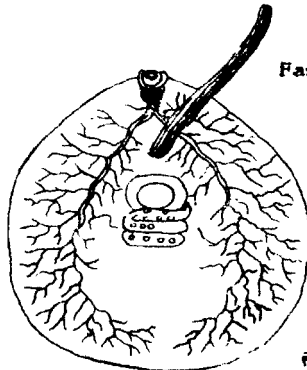
After Cobbold.



About natural size.

Fig. 29.

Liver fluke
Fasciola Jacksoni enlarged.



After Cobbold.

Fig. 30

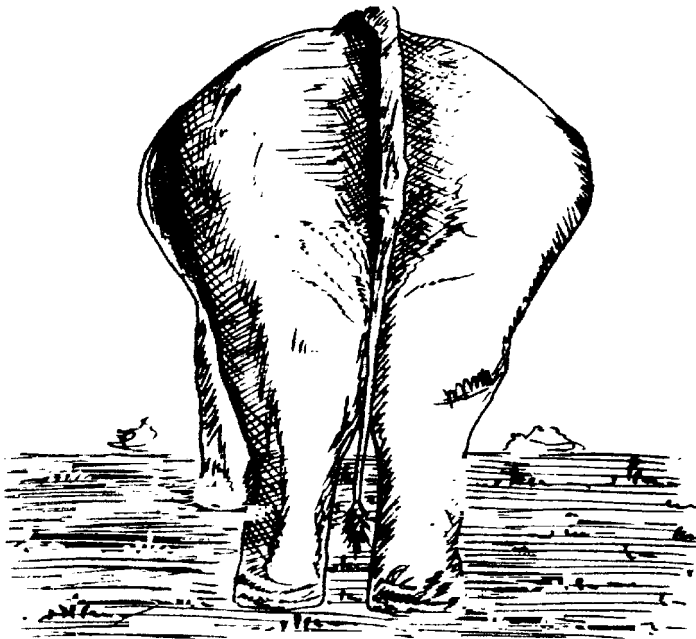


Fig. 31.

Case of soreback showing the healed cicatrices
after the use of the knife (Sanderson).

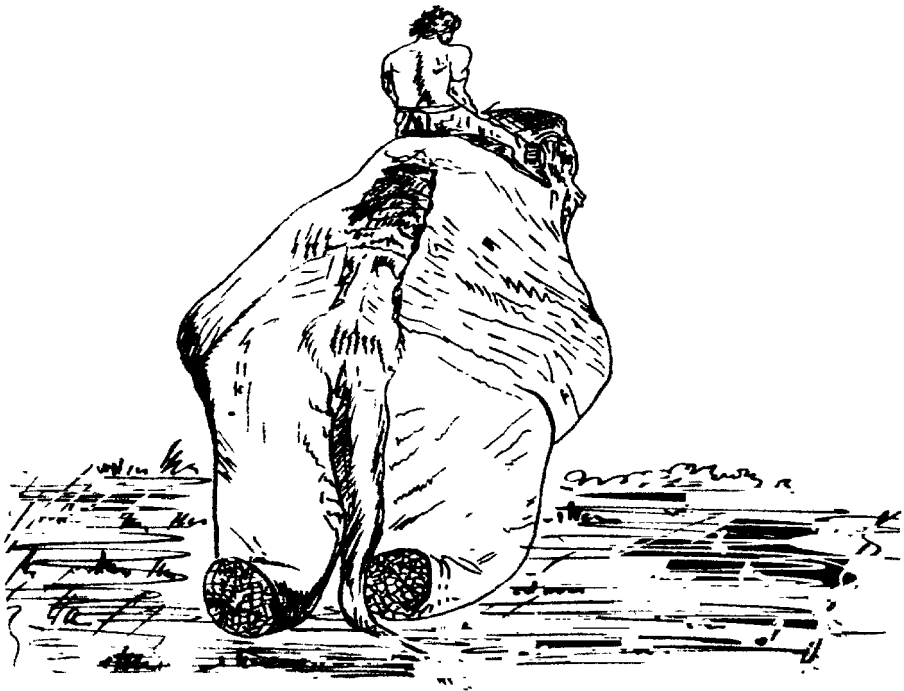


Fig. 32.

Elephant with Prominent Spinal Ridge.
After Sanderson.

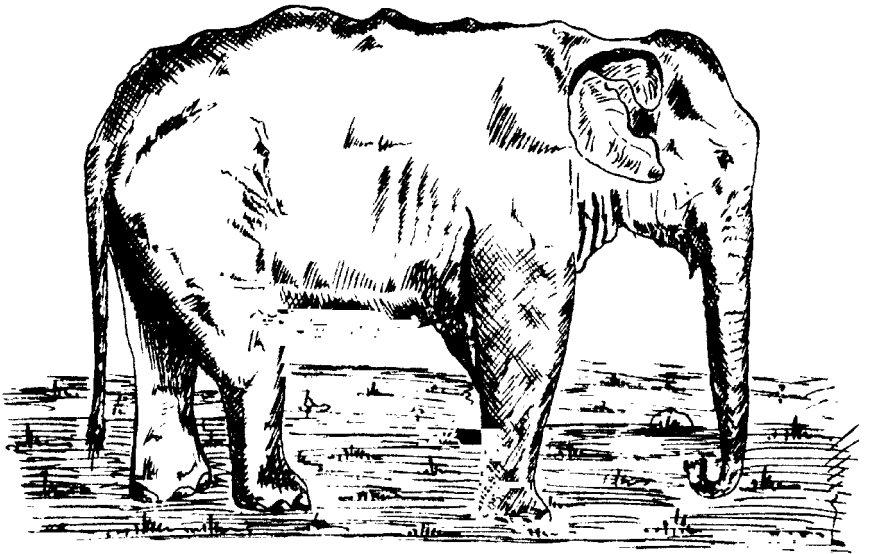


Fig. 33.

Case of loss of some of the Spinal Processes
from soreback. (Sanderson.)

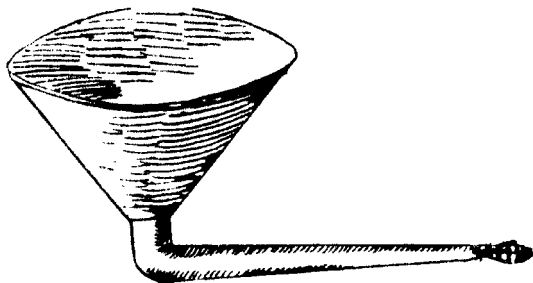
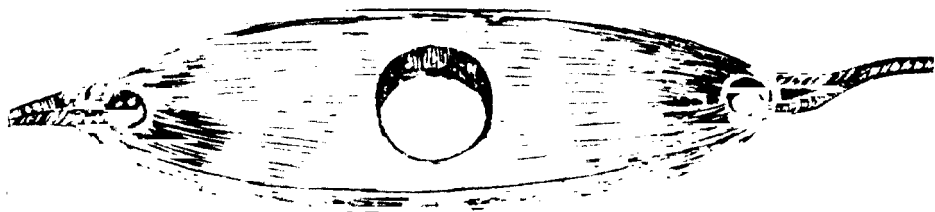


Fig 34

Enema Funnel.

WOODEN GAG FOR ADMINISTRATION OF MEDICINE.



35

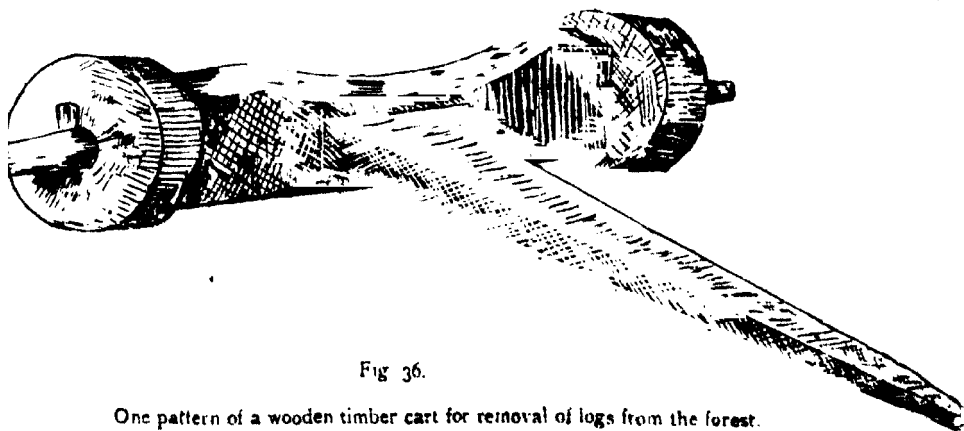


Fig 36.

One pattern of a wooden timber cart for removal of logs from the forest.

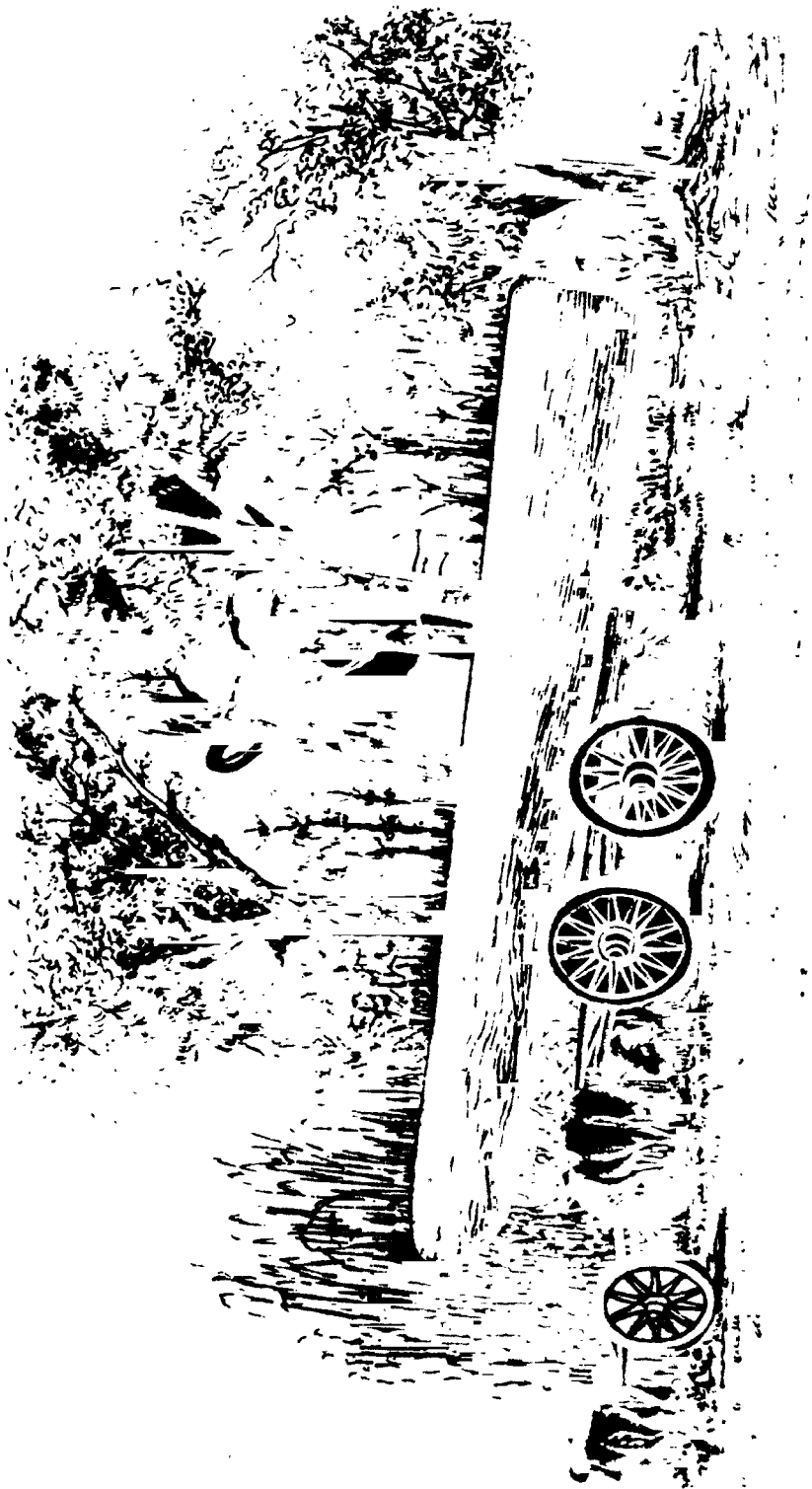


Fig. 36 (4) Four-wheeled cart for transporting timber.

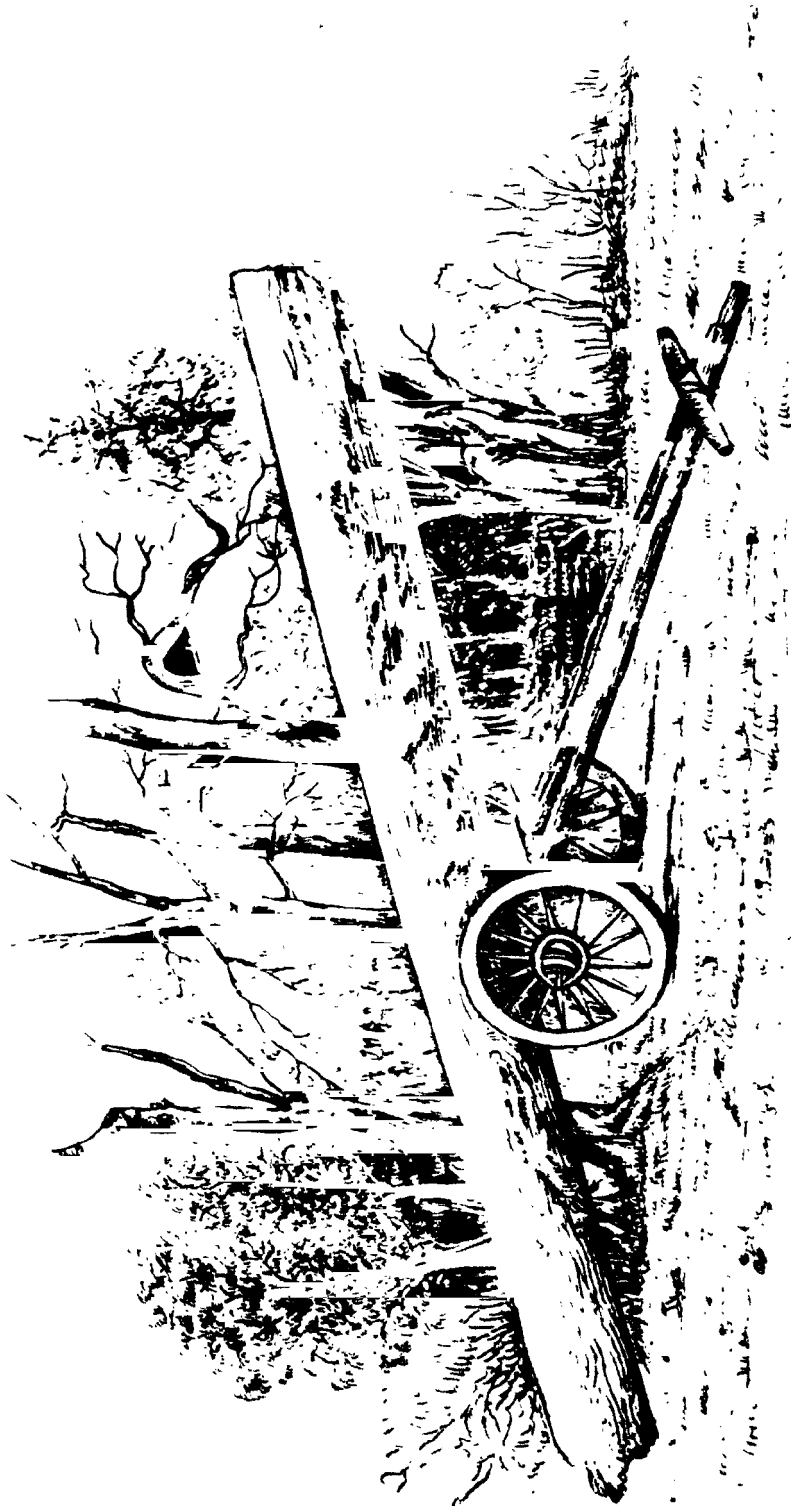


Fig. 36 (b). Two-wheeled cart for transporting timber.

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